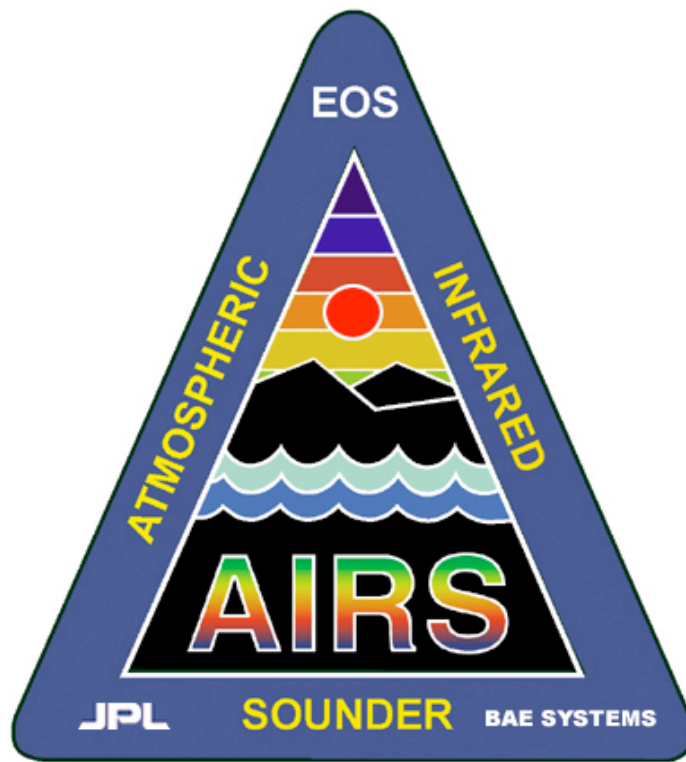


*AIRS*  
Atmospheric Infrared Sounder

# AIRS Version 4.0 Released Files Description



March 2005  
Version 1.0



Jet Propulsion Laboratory  
California Institute of Technology  
Pasadena, California

JPL D-31502

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*AIRS*  
Atmospheric Infrared Sounder

# AIRS Version 4.0 Released Files Description

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## Document Change Log

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March 2005	Initial Release	

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# 1 Introduction

## 1.1 Purpose

This document describes the released product files for the Version 4.0.9.0 (V4.0.9.0) delivery of the AIRS Science Processing System (ASPS). These products incorporate data from the AIRS, AMSU-A (AMSU-A1 + AMSU-A2) and HSB instruments.

## 1.2 Product Overview

Level 1B science data is calibrated instrument measurements in physical units. Data from the AIRS instrument is divided into separate products: AIRIBRAD has infrared data, while AIRVBRAD has Vis/NIR data. The corresponding AIRIBQAP and AIRVBQAP QA subset files exclude radiances and other large fields to deliver quality information in a compact format.

AIRS IR and Vis/NIR radiances are in radiance units, while MW instrument data AIRABRAD and AIRHBRAD are in brightness temperature units.

In Level 2 atmospheric and surface quantities are estimated from the Level 1B data.

Level 2 products are cloud-cleared radiances (AIRI2CCF) and atmospheric parameters (AIRX2RET and AIRX2SUP). The standard retrieval product AIRX2RET is designed for the general user, while the support product (ARIX2SUP) contains interim and experimental portions intended for use by the AIRS team and others willing to make a significant investment of time in understanding the product.

Each Level 1B and Level 2 science file type contains data from 6 minutes of observations in HDF-EOS Swath format.

Level 3 files grid data from AIRX2RET standard retrieval product in daily (AIRX3STD), eight-day (AIRX3ST8), and monthly (AIRX3STM) HDF-EOS Grid products.

The Daily Browse summary global images (AIRxxDBR) of Level 1B or Level 2 products are useful for a quick look at data and as an aide to ordering.

AIRS products are archived at the GSFC DAAC archive. These product formats are defined in the product interface specifications, provided in Appendix A.

The basic product and QA file types are shown in Table 1.

**Table 1. Product and QA File Types**

<i>ESDT Shortname</i>	<i>Mnemonic Name</i>
-----------------------	----------------------

<i>AIRIBRAD</i>	L1B_AIRS_SCIENCE
<i>AIRIBQAP</i>	L1B_AIRS_QA
<i>AIRVBRAD</i>	L1B_VIS_SCIENCE
<i>AIRVBQAP</i>	L1B_VIS_QA
<i>AIRABRAD</i>	L1B_AMSU_SCIENCE
<i>AIRHBRAD</i>	L1B_HSB_SCIENCE
<i>AIRX2RET</i>	L2_Standard_atmospheric&surface_product
<i>AIRI2CCF</i>	L2_Standard_cloud-cleared_radiance_product
<i>AIRX2SUP</i>	L2_Support_atmospheric&surface_product
<i>AIRX3STD</i>	L3_Standard_Daily
<i>AIRX3ST8</i>	L3_Standard_Multiday
<i>AIRX3STM</i>	L3_Standard_Monthly

### **1.3 Applicable Documents**

AIRS Version 4.0 Processing Files Description, JPL D-31231, February 2005

AIRS Version 3.0 Processing Files Description, JPL D-26382, June 2003

AIRS Version 2.7 Processing Files Description, JPL D-25941, March 2003

AIRS Version 2.5.1 Processing Files Description, JPL D-20001, September 2002

Interface Control Document between the Earth Science Data and Information System (ESDIS) and the AIRS Science Processing Systems (ASPS), Earth Science Data and Information System Project Number 423-42-07, JPL D-22992, February 2002

Operations Agreement (OA) between the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC) and the AIRS Team Leader Science Computing Facility (TLSCF), JPL D-23045, January 2002

AIRS Science Processing System Software Development Methodology, JPL D-18573, February 19, 2000

AIRS Product Generation System (PGS) Version 2.1 Requirements and Design Document, JPL D-19556, January 2001

AIRS Product Generation System (PGS) Version 1.5 Requirements and Design Document, JPL D-18926, January 2001

AIRS Product Generation System (PGS) Version 1 Requirements and Design Document (Preliminary), JPL D-17851, Version 1.1, July 1999

AIRS Version 2.0 System Description Document, Version 2.0, JPL D-19557, August 2000

AIRS Science Software Integration and Test Procedures and Agreement with the Goddard Distributed Active Archive Center, JPL D-16791, Version 3, Revision 2.0, June 1, 2000

AIRS Product Generation System (PGS) Prototype 8 Requirements and Design Document (Preliminary), JPL D-16451, Version 1.0, December 1998

AIRS Data Processing and Instrument Operations (DPIO) Software Requirements Document, JPL D-16785, Version 1.0, April 3, 1998

## **1.4 Acronyms**

AIRS	Atmospheric Infrared Sounder
AMSU-A	Advanced Microwave Sounding Unit - Version A (AMSU-A1 and AMSU-A2)
APID	Application Process Identifier
ASPS	AIRS Science Processing System
AVN	Aviation (Global Forecast System Model)
BRTEMP	Brightness Temperature
DAAC	Distributed Active Archive Center
DECOM	Decommuration
DN	Data Number
DPIO	Data Processing and Instrument Operations
ECS	EOSDIS Core System
EDOS	EOS Data Operations Service
EMOS	EOS Mission Operations System
ENG	Engineering
EOS	Earth Observing System
ESDIS	Earth Science and Data Information System
ESDT	Earth Science Data Type
GCM	General Circulation Model
GRIB	GRIdded Binary
GSFC	Goddard Space Flight Center
HSB	Humidity Sounder for Brazil
HDF	Hierarchical Data Format
ICD	Interface Control Document
IR	Infrared
L1A	Level 1A
L1B	Level 1B
L2	Level 2
L3	Level 3
LGID	Local Granule ID
LID	Logical ID
MW	Microwave
NCEP	National Centers for Environmental Prediction

NDVI	Normalized Differential Vegetation Index
NIR	Near Infrared
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OA	Operations Agreement
PCF	Process Control File
PDS	Product Description Section (NCEP Office Note 388 (ON388))
PGE	Product Generation Executive
PGS	Product Generation System
PSA	Product Specific Attributes
QA	Quality Assessment
SCF	Science Computing Facility
SDPS	Science and Data Processing Segment
SPS	Science Processing System
SSI&T	Science Software Integration and Test
TAI	Universal Atomic Time
TLSCF	Team Leader Science Computing Facility
UR	Universal Reference
UTC	Coordinated Universal Time
Vis	Visible
WMO	World Meteorological Organization

## **Appendix A1. Single-Swath Fixed-Format Product Interface Specifications**

These products have exactly one swath per file. The swath name is given in the interface specification as "Swath Name."

All dimensions, geolocation fields, fields and attributes have names exactly corresponding to the contents of the "Name" column of the appropriate table, including underscores and capitalization.

The "Explanation" information, as provided in the product interface specifications, is a guide for users of the data and is not included the product files.

The contents of the "Type" column of the attribute and field tables can either specify a standard HDF type or a special AIRS type. The standard HDF types used by AIRS are:

string of 8-bit characters (Attributes only)

8-bit integer

8-bit unsigned integer

16-bit integer

16-bit unsigned integer

32-bit integer

32-bit unsigned integer

32-bit floating-point

64-bit floating-point

For all 16-bit or longer fields the value -9999 is used to flag bad data. Special AIRS types are like structures, with the fields specified in tables as discussed below.

The first table of the interface specification lists "Dimensions" which are the HDF-EOS swath dimensions. The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "GeoTrack" is understood to be the dimension along the path of the spacecraft, and "GeoXTrack" is the dimension across the spacecraft track, starting on the left looking forward along the spacecraft track. There may also be a second across-track dimension "CalXTrack," equivalent to "GeoXTrack," except that "CalXTrack" refers to the number of calibration footprints per scanline.

"GeoTrack" will vary, depending on the size of the data set being tested. For nominal 6-minute data sets, it will be 45 for large-spot products (AMSU-A, Level 2, cloud-cleared AIRS) and 135 for small-spot products (AIRS, Vis/NIR, HSB). All other dimensions will remain fixed at the values specified in the product interface specification.

These files contain no geolocation mappings or indexed mappings.

The second table specifies "geolocation fields." These are all 64-bit floating-point fields that give the location of the data in space and time. If the note before the table specifies that these fields appear once per scanline then they have the single dimension "GeoTrack." Otherwise, they appear once per footprint per scanline and have dimensions "GeoTrack,GeoXTrack."

The third table specifies "Attributes." These are scalar or string fields that appear only once per granule. They are attributes in the HDF-EOS Swath sense.

The fourth table specifies "Per-Granule Data Fields." These are fields which are valid for the entire granule but are not scalars because they have some additional dimension.

The fifth table specifies "Along-Track Data Fields." These are fields that occur once for every scanline. These fields have dimension "GeoTrack" before any "Extra Dimensions." So an "Along-Track Data Field" with "Extra Dimensions" of "None" has dimensions "GeoTrack"; whereas, if the "Extra Dimensions" is "SpaceXTrack (= 4)," then it has dimensions "GeoTrack,SpaceXTrack."

The sixth table specifies "Full Swath Data Fields." These are fields that occur once for every footprint of every scanline. These have dimensions "GeoTrack,GeoXTrack" before any "Extra Dimensions." So a "Full Swath Data Field" with "Extra Dimensions" of "None" has dimensions "GeoTrack,GeoXTrack"; whereas, if the "Extra Dimensions" is "Channel (= 2378)," then it has dimensions "GeoTrack,GeoXTrack,Channel."

Some Level-1A files include an additional table called "Calibration Swath Data Fields" which specifies all the fields that occur once for every calibration footprint of every scanline. These fields have dimensions "GeoTrack,CalXTrack" before any "Extra Dimensions." So a "Calibration Swath Data Field" with "Extra Dimensions" of "None" has dimensions "GeoTrack,CalXTrack"; whereas, if "Extra Dimensions" is "Channel (= 15)," then it has dimensions "GeoTrack,CalXTrack,Channel."

The last section of the interface specification contains a table for "Special AIRS Types." These special AIRS types are used as "shorthand" for groups of fields, listed in the "Attributes," "Along-Track Data Fields" and "Full Swath Data Fields" tables as single fields. If the name of a special AIRS type appears in the "Type" column of one of these tables in place of a standard type, then there are really as many fields as there are rows in the corresponding type table, each with a name made up of the "Name" from the upper table followed by a "." and the "Field Name" from the lower table.

For example, consider a field in the "Attributes" table named "apid\_415\_cnt" of type "AIRS Engineering Packet Counts." If the table for "AIRS Engineering Packet Counts" under "Special AIRS Types" lists the three fields "missing\_in," "missing\_ends" and "good," then the swath contains the three fields "apid\_415\_cnt.missing\_in," "apid\_415\_cnt.missing\_ends," and "apid\_415\_cnt.good."

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### A1-1. L1B AIRS Science Interface Specification

Interface Specification Version 4.0.9.0

2005-02-01

ESDT ShortName = "AIRIBRAD"

Swath Name = "L1B\_AIRS\_Science"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

#### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields" have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
CalXTrack	6	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AIRS_CALIB) (Footprints are ordered: 1-4: spaceviews (ports 3, 4, 1, 2); 5: blackbody radiometric calibration source; 6: spectral/photometric calibration sources)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_SPACE)
BBXTrack	1	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_BB)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
MaxRefChannel	100	Maximum number of radiometric reference channels. "RefChannels" lists the channels used.
MaxFeaturesUpwell	35	Maximum number of spectral features in upwelling radiances used

## A1-1. L1B AIRS Science Interface Specification

		for spectral calibration
MaxFeaturesPary	17	Maximum number of spectral features in parylene radiances used for spectral calibration

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or

## A1-1. L1B AIRS Science Interface Specification

		"SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)

## A1-1. L1B AIRS Science Interface Specification

orbitgeoqa	32-bit unsigned integer	<p>Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline);</p> <p>bit 1: bad input value (first scanline);</p> <p>bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT;</p> <p>bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT;</p> <p>bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG;</p> <p>bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT;</p> <p>bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1;</p> <p>bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME;</p> <p>bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE;</p> <p>bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE;</p> <p>bit 23: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT;</p> <p>bit 25-31: not used</p>
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glntgeoqa	16-bit integer	Number of scans with problems in glntgeoqa

## A1-1. L1B AIRS Science Interface Specification

num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
CalGranSummary	8-bit unsigned integer	Bit field. Bitwise OR of CalChanSummary, over all good channels (see ExcludedChans) Zero means all good channels were well calibrated, for all scanlines. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
DCR_scan	16-bit integer	Scanline number following (first) DC-Restore. 0 for no DC-Restore
input_bb_temp	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature
input_bb_temp1	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 1A (CaBbTempV1A or CaBbTempV1B, as active)
input_bb_temp2	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 2 (CaBbTempV2A or CaBbTempV2B, as active)
input_bb_temp3	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 3 (CaBbTemp3, active A or B)
input_bb_temp4	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature4 (CaBbTemp4, active A or B)

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input_spec_temp	Limited Engineering Struct (see below)	Input statistics on Spectrometer temperature
input_ir_det_temp	Limited Engineering Struct (see below)	Input statistics on IR detector temperature
input_grating_temp_1	Limited Engineering Struct (see below)	Input statistics on Grating temperature 1 (SpGratngTemp1, active A or B)
input_grating_temp_2	Limited Engineering Struct (see below)	Input statistics on Grating temperature 2 (SpGratngTemp2, active A or B)
input_entr_filt_temp	Limited Engineering Struct (see below)	Input statistics on the entrance filter temperature (SpEntFiltTmp, active A or B)
input_opt_bench_temp_2	Limited Engineering Struct (see below)	Input statistics on optical bench temperature 2 (SpOptBnchTmp2, active A or B)
input_opt_bench_temp_3	Limited Engineering Struct (see below)	Input statistics on optical bench temperature 3 (SpOptBnchTmp3, active A or B)
input_scan_mirror_temp	Limited Engineering Struct (see below)	Input statistics on scan mirror housing temperature
input_chopper_phase_err	Limited Engineering Struct (see below)	Input statistics on chopper phase error voltage (ChPhaseErrVA or ChPhaseErrVB, as active)
PopCount	32-bit integer	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
NumRefChannels	32-bit integer	The number of channels reported in MaxRefChannel arrays
Rdiff_swindow_M1a_chan	16-bit integer	Array M1a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_swindow_M2a_chan	16-bit integer	Array M2a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M8_chan	16-bit integer	Array M8 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays

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		1...2378)
Rdiff_lwindow_M9_chan	16-bit integer	Array M9 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
spectral_TAI	64-bit floating-point	TAI time of (first) Spectral calibration. (floating-point elapsed seconds since start of 1993) 0 for no Spectral calibration occurred in this granule.
spec_shift_upwell	32-bit floating-point	Focal plane shift calculated in grating model fit to upwelling radiances (microns)
spec_shift_unc_upwell	32-bit floating-point	Uncertainty of the focal plane shift calculated in the grating model fit to upwelling radiances (microns)
spec_fl_upwell	32-bit floating-point	Focal length calculated in grating model fit to upwelling radiances (microns)
spec_fl_unc_upwell	32-bit floating-point	Uncertainty of focal length calculated in grating model fit to upwelling radiances (microns)
SpectralFeaturesUpwell	32-bit integer	The actual number of upwelling features for MaxFeaturesUpwell-sized arrays
spec_iter_upwell	16-bit integer	Number of amoeba iterations to fit the grating model to upwelling radiance feature positions
spec_clim_select	16-bit integer	Number of the climatology to which the upwelling features were fitted
spec_shift_pary	32-bit floating-point	Focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_shift_unc_pary	32-bit floating-point	Uncertainty of the focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_fl_pary	32-bit floating-point	Focal length calculated in grating model fit to parylene radiances (microns)
spec_fl_unc_pary	32-bit floating-point	Uncertainty of focal length calculated in grating model fit to parylene radiances (microns)
SpectralFeaturesPary	32-bit integer	The actual number of parylene features for MaxFeaturesPary-sized arrays
spec_iter_pary	16-bit integer	Number of amoeba iterations in fit the grating model to parylene radiance feature positions
DCRCount	32-bit integer	Number of times a Direct Current Restore was executed for any module

Size: 1371 bytes (0.0 MB) per granule

### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
CalChanSummary	8-bit unsigned integer	Channel (= 2378)	Bit field. Bitwise OR of CalFlag, by channel, over all scanlines. Noise threshold and

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			spectral quality added. Zero means the channel was well calibrated for all scanlines bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
ExcludedChans	8-bit unsigned integer	Channel (= 2378)	An integer 0-6, indicating A/B detector weights. Used in L1B processing. 0 - A weight = B weight. Probably better than channels with state > 2; 1 - A-side only. Probably better than channels with state > 2; 2 - B-side only. Probably better than channels with state > 2; 3 - A weight = B weight. Probably better than channels with state = 6; 4 - A-side only. Probably better than channels with state = 6; 5 - B-side only. Probably better than channels with state = 6; 6 - A weight = B weight.
NeN	32-bit floating-point	Channel (= 2378)	Noise-equivalent Radiance (radiance units) for an assumed 250K scene
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on scene data numbers
input_space_counts	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview data numbers
input_space_signals	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview signals (data numbers with offset subtracted)
input_space_diffs	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Statistics on differences between corresponding space views, for consecutive scanlines
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration data numbers

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	below)		
input_bb_signals	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration signals (data numbers with offset subtracted)
input_spec_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on spectral calibration data numbers
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on offsets
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on gains
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on radiances (radiance units)
Gain	32-bit floating-point	Channel (= 2378)	Number of radiance units per count
RefChannels	32-bit integer	MaxRefChannel (= 100)	The 1-based indexes of channels reported in MaxRefChannel arrays
rad_scan_stats	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * MaxRefChannel (= 100)	Statistics on scan angle dependence of radiances
nominal_freq	32-bit floating-point	Channel (= 2378)	Nominal frequencies (in cm <sup>-1</sup> ) of each channel
spectral_freq	32-bit floating-point	Channel (= 2378)	Calculated frequencies (in cm <sup>-1</sup> )
spectral_freq_unc	32-bit floating-point	Channel (= 2378)	Uncertainty in calculated frequencies (in cm <sup>-1</sup> )
spec_feature_shifts_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Spectral shift seen for each upwelling feature, in microns at the focal plane
spec_feature_corr_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Maximum correlation seen for each upwelling feature (0.0 ... 1.0)
spec_feature_sharp_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Quadratic coefficient in fit to correlation for each upwelling feature
spec_feature_resid_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Fit residual for each upwelling feature (wavenumbers)
spec_feature_contrast_stats	Limited Engineering	MaxFeaturesUpwell (= 35)	Statistics on the spectral contrasts for each of the

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	Struct (see below)		upwelling features, for each of the scene footprints considered for spectral calibration
spec_feature_shifts_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Spectral shift seen for each parylene feature, in microns at the focal plane
spec_feature_corr_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Maximum correlation seen for each parylene feature (0.0 ... 1.0)
spec_feature_sharp_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Quadratic coefficient in fit to correlation for each parylene feature
spec_feature_resid_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Fit residual for each parylene feature (wavenumbers)
ave_pary_spectrum	32-bit floating-point	Channel (= 2378)	The average parylene spectrum (over good scanlines), in milliWatts/m**2/cm**-1/steradian

Size: 3784916 bytes (3.8 MB) per granule

### Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE;

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			<p>bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;</p> <p>bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED;</p> <p>bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT;</p> <p>bit 13: PGS_CSC_ECtoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 14: PGS_CSC_ECtoECR() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_ECtoECR() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 16: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 17: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 18: unused (set to zero);</p> <p>bit 19: PGS_CSC_ECtoECR() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_ECtoECR() returned PGS_E_TOOLKIT;</p> <p>bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS;</p> <p>bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE;</p> <p>bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY;</p> <p>bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING;</p> <p>bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL;</p> <p>bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL;</p> <p>bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT;</p> <p>bit 28-31: not used</p>
glintgeoqa	16-bit unsigned integer	None	<p>Glint Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: glint location in Earth's shadow;</p> <p>bit 2: glint calculation not converging;</p> <p>bit 3: glint location sun vs. satellite zenith mismatch;</p> <p>bit 4: glint location sun vs. satellite azimuth mismatch;</p>

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			bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECtoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ; bit 15: PGS_CSC_ECtoECR() returned any 'E' class return code
moongeoqa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAltoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAltoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit	None	TAI time at which instrument is nominally looking

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	floating-point		directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
CalScanSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalFlag over the good channel list (see ExcludedChans). Zero means all "good" channels were well calibrated for this scanline bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: cold scene noise
CalFlag	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for the current scanline. Zero means the channel was well calibrated, for this scanline. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: cold scene noise
SpaceViewDelta	32-bit floating-point	Channel (= 2378)	The mean of the four spaceviews immediately following the Earth views in the scanline, minus the mean of the spaceviews immediately preceding the Earth views in the scanline (also the magnitude of a "pop" in this scanline, when the "pop detected" bit is set in CalFlag.) (data numbers)
spaceview_selection	8-bit unsigned integer	None	Indicates which footprints were included for this scan. Each bit is high when the corresponding space view is used in the spaceview offset calculation. (See L1B Processing Requirements, section 6.2); LSB is first space view.

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OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; bit 7 quicklook (expedited) flag; bits 8-11 submode bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag
DpCircCount	16-bit unsigned integer	None	Data Processing circumvention counts (active A or B) (counts)
DpCircBasThr	16-bit unsigned integer	None	Data Processing circumvention base threshold (active A or B)

Size: 1613925 bytes (1.6 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
radiances	32-bit floating-point	Channel (= 2378)	Radiances for each channel in milliWatts/m**2/cm**-1/steradian
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned

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			<p>PGSCSC_W_DATA_FILE_MISSING;  bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD;  bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY;  bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS;  bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR;  bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR;  bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1;  bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE;  bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT;  bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;  bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE;  bit 22-31: not used</p>
zengeoqa	16-bit unsigned integer	None	<p>Satellite zenith Geolocation QA flags: bit 0 (LSB):  (Spacecraft) bad input value;  bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON;  bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH;  bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION;  bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG;  bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;  bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR;  bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT;  bit 8: (Sun) bad input value;  bit 9: (suppressed)  PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night);  bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH;  bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION;  bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG;  bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;  bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR;  bit 15: PGS_CSC_ZenithAzimuth(Sun) returned</p>

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			PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDEM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDEM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDEM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDEM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit	None	Error estimate for topog

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	floating-point		
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
Rdiff_swindow	32-bit floating-point	None	Radiance difference in the 2560 cm <sup>-1</sup> window region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_swindow_M1a_chan) - radiance(Rdiff_swindow_M2a_chan). (radiance units)
Rdiff_lwindow	32-bit floating-point	None	Radiance difference in the longwave window(850 cm <sup>-1</sup> ) used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_lwindow_M8_chan) - radiance(Rdiff_lwindow_M9_chan). (radiance units)
SceneInhomogeneous	8-bit unsigned integer	None	Threshold test for scene inhomogeneity, using band-overlap detectors (bit fields); bit 7 (MSB, value 128): scene is inhomogeneous, as determined by the Rdiff_swindow threshold. For v4.0 the test is $\text{abs}(\text{Rdiff\_swindow}) > 5 * \sqrt{\text{NeN}(\text{Rdiff\_swindow\_M1a\_chan})^2 + \text{NeN}(\text{Rdiff\_swindow\_M2a\_chan})}$ ; bit 6 (value 64): scene is inhomogeneous, as determined by the Rdiff_lwindow threshold. For v4.0 the test is $\text{abs}(\text{Rdiff\_lwindow}) > 5 * \sqrt{\text{NeN}(\text{Rdiff\_lwindow\_M8\_chan})^2 + \text{NeN}(\text{Rdiff\_lwindow\_M9\_chan})}$ ; bits 5-0: unused (reserved)

Size: 116287650 bytes (116.3 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
121979462 bytes (122.0 MB) per 45-scanset granule = 29275.1 MB per day**

### Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "input\_scene\_counts" involves reading HDF-EOS Swath field "input\_scene\_counts.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit	Maximum value field takes on in granule (not valid when num_in = 0)

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	floating-point	
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found



## A1-2. L1B AIRS QA Interface Specification

Interface Specification Version 4.0.9.0  
2005-02-01

ESDT ShortName = "AIRIBQAP"

Swath Name = "L1B\_AIRS\_QA"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
CalXTrack	6	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AIRS_CALIB) (Footprints are ordered: 1-4: spaceviews (ports 3, 4, 1, 2); 5: blackbody radiometric calibration source; 6: spectral/photometric calibration sources)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_SPACE)
BBXTrack	1	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AIRS_BB)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
MaxRefChannel	100	Maximum number of radiometric reference channels. "RefChannels" lists the channels used.

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MaxFeaturesUpwell	35	Maximum number of spectral features in upwelling radiances used for spectral calibration
MaxFeaturesPary	17	Maximum number of spectral features in parylene radiances used for spectral calibration

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending

## A1-2. L1B AIRS QA Interface Specification

		or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)

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orbitgeoqa	32-bit unsigned integer	<p>Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline);</p> <p>bit 1: bad input value (first scanline);</p> <p>bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT;</p> <p>bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT;</p> <p>bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG;</p> <p>bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT;</p> <p>bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1;</p> <p>bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME;</p> <p>bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE;</p> <p>bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE;</p> <p>bit 23: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT;</p> <p>bit 25-31: not used</p>
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glntgeoqa	16-bit integer	Number of scans with problems in glntgeoqa

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num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
CalGranSummary	8-bit unsigned integer	Bit field. Bitwise OR of CalChanSummary, over all good channels (see ExcludedChans) Zero means all good channels were well calibrated, for all scanlines. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
DCR_scan	16-bit integer	Scanline number following (first) DC-Restore. 0 for no DC-Restore
input_bb_temp	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature
input_bb_temp1	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 1A (CaBbTempV1A or CaBbTempV1B, as active)
input_bb_temp2	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 2 (CaBbTempV2A or CaBbTempV2B, as active)
input_bb_temp3	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature 3 (CaBbTemp3, active A or B)
input_bb_temp4	Limited Engineering Struct (see below)	Input statistics on Blackbody temperature4 (CaBbTemp4, active A or B)

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input_spec_temp	Limited Engineering Struct (see below)	Input statistics on Spectrometer temperature
input_ir_det_temp	Limited Engineering Struct (see below)	Input statistics on IR detector temperature
input_grating_temp_1	Limited Engineering Struct (see below)	Input statistics on Grating temperature 1 (SpGratngTemp1, active A or B)
input_grating_temp_2	Limited Engineering Struct (see below)	Input statistics on Grating temperature 2 (SpGratngTemp2, active A or B)
input_entr_filt_temp	Limited Engineering Struct (see below)	Input statistics on the entrance filter temperature (SpEntFiltTmp, active A or B)
input_opt_bench_temp_2	Limited Engineering Struct (see below)	Input statistics on optical bench temperature 2 (SpOptBnchTmp2, active A or B)
input_opt_bench_temp_3	Limited Engineering Struct (see below)	Input statistics on optical bench temperature 3 (SpOptBnchTmp3, active A or B)
input_scan_mirror_temp	Limited Engineering Struct (see below)	Input statistics on scan mirror housing temperature
input_chopper_phase_err	Limited Engineering Struct (see below)	Input statistics on chopper phase error voltage (ChPhaseErrVA or ChPhaseErrVB, as active)
PopCount	32-bit integer	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
NumRefChannels	32-bit integer	The number of channels reported in MaxRefChannel arrays
Rdiff_swindow_M1a_chan	16-bit integer	Array M1a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_swindow_M2a_chan	16-bit integer	Array M2a channel used as one reference in calculating Rdiff_swindow. (index into radiance & frequency arrays 1...2378)
Rdiff_lwindow_M8_chan	16-bit integer	Array M8 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays

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		1...2378)
Rdiff_lwindow_M9_chan	16-bit integer	Array M9 channel used as one reference in calculating Rdiff_lwindow. (index into radiance & frequency arrays 1...2378)
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
spectral_TAI	64-bit floating-point	TAI time of (first) Spectral calibration. (floating-point elapsed seconds since start of 1993) 0 for no Spectral calibration occurred in this granule.
spec_shift_upwell	32-bit floating-point	Focal plane shift calculated in grating model fit to upwelling radiances (microns)
spec_shift_unc_upwell	32-bit floating-point	Uncertainty of the focal plane shift calculated in the grating model fit to upwelling radiances (microns)
spec_fl_upwell	32-bit floating-point	Focal length calculated in grating model fit to upwelling radiances (microns)
spec_fl_unc_upwell	32-bit floating-point	Uncertainty of focal length calculated in grating model fit to upwelling radiances (microns)
SpectralFeaturesUpwell	32-bit integer	The actual number of upwelling features for MaxFeaturesUpwell-sized arrays
spec_iter_upwell	16-bit integer	Number of amoeba iterations to fit the grating model to upwelling radiance feature positions
spec_clim_select	16-bit integer	Number of the climatology to which the upwelling features were fitted
spec_shift_pary	32-bit floating-point	Focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_shift_unc_pary	32-bit floating-point	Uncertainty of the focal plane shift calculated in grating model fit to parylene radiances (microns)
spec_fl_pary	32-bit floating-point	Focal length calculated in grating model fit to parylene radiances (microns)
spec_fl_unc_pary	32-bit floating-point	Uncertainty of focal length calculated in grating model fit to parylene radiances (microns)
SpectralFeaturesPary	32-bit integer	The actual number of parylene features for MaxFeaturesPary-sized arrays
spec_iter_pary	16-bit integer	Number of amoeba iterations in fit the grating model to parylene radiance feature positions
DCRCount	32-bit integer	Number of times a Direct Current Restore was executed for any module

Size: 1371 bytes (0.0 MB) per granule

### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
CalChanSummary	8-bit unsigned integer	Channel (= 2378)	Bit field. Bitwise OR of CalFlag, by channel, over all scanlines. Noise threshold and

## A1-2. L1B AIRS QA Interface Specification

			<p>spectral quality added. Zero means the channel was well calibrated for all scanlines bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);</p>
ExcludedChans	8-bit unsigned integer	Channel (= 2378)	<p>An integer 0-6, indicating A/B detector weights. Used in L1B processing. 0 - A weight = B weight. Probably better than channels with state &gt; 2; 1 - A-side only. Probably better than channels with state &gt; 2; 2 - B-side only. Probably better than channels with state &gt; 2; 3 - A weight = B weight. Probably better than channels with state = 6; 4 - A-side only. Probably better than channels with state = 6; 5 - B-side only. Probably better than channels with state = 6; 6 - A weight = B weight.</p>
NeN	32-bit floating-point	Channel (= 2378)	Noise-equivalent Radiance (radiance units) for an assumed 250K scene
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on scene data numbers
input_space_counts	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview data numbers
input_space_signals	Limited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Input statistics on spaceview signals (data numbers with offset subtracted)
input_space_diffs	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 2378)	Statistics on differences between corresponding space views, for consecutive scanlines
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration data numbers

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	below)		
input_bb_signals	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on blackbody calibration signals (data numbers with offset subtracted)
input_spec_counts	Limited Engineering Struct (see below)	Channel (= 2378)	Input statistics on spectral calibration data numbers
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on offsets
gain_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on gains
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 2378)	Statistics on radiances (radiance units)
Gain	32-bit floating-point	Channel (= 2378)	Number of radiance units per count
RefChannels	32-bit integer	MaxRefChannel (= 100)	The 1-based indexes of channels reported in MaxRefChannel arrays
rad_scan_stats	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * MaxRefChannel (= 100)	Statistics on scan angle dependence of radiances
nominal_freq	32-bit floating-point	Channel (= 2378)	Nominal frequencies (in cm <sup>-1</sup> ) of each channel
spectral_freq	32-bit floating-point	Channel (= 2378)	Calculated frequencies (in cm <sup>-1</sup> )
spectral_freq_unc	32-bit floating-point	Channel (= 2378)	Uncertainty in calculated frequencies (in cm <sup>-1</sup> )
spec_feature_shifts_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Spectral shift seen for each upwelling feature, in microns at the focal plane
spec_feature_corr_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Maximum correlation seen for each upwelling feature (0.0 ... 1.0)
spec_feature_sharp_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Quadratic coefficient in fit to correlation for each upwelling feature
spec_feature_resid_upwell	32-bit floating-point	MaxFeaturesUpwell (= 35)	Fit residual for each upwelling feature (wavenumbers)
spec_feature_contrast_stats	Limited Engineering	MaxFeaturesUpwell (= 35)	Statistics on the spectral contrasts for each of the

## A1-2. L1B AIRS QA Interface Specification

	Struct (see below)		upwelling features, for each of the scene footprints considered for spectral calibration
spec_feature_shifts_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Spectral shift seen for each parylene feature, in microns at the focal plane
spec_feature_corr_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Maximum correlation seen for each parylene feature (0.0 ... 1.0)
spec_feature_sharp_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Quadratic coefficient in fit to correlation for each parylene feature
spec_feature_resid_pary	32-bit floating-point	MaxFeaturesPary (= 17)	Fit residual for each parylene feature (wavenumbers)
ave_pary_spectrum	32-bit floating-point	Channel (= 2378)	The average parylene spectrum (over good scanlines), in milliWatts/m**2/cm**-1/steradian

Size: 3784916 bytes (3.8 MB) per granule

### Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE;

## A1-2. L1B AIRS QA Interface Specification

			<p>bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;</p> <p>bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED;</p> <p>bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT;</p> <p>bit 13: PGS_CSC_ECtoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 14: PGS_CSC_ECtoECR() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_ECtoECR() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 16: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 17: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 18: unused (set to zero);</p> <p>bit 19: PGS_CSC_ECtoECR() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_ECtoECR() returned PGS_E_TOOLKIT;</p> <p>bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS;</p> <p>bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE;</p> <p>bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY;</p> <p>bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING;</p> <p>bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL;</p> <p>bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL;</p> <p>bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT;</p> <p>bit 28-31: not used</p>
glintgeoqa	16-bit unsigned integer	None	<p>Glint Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: glint location in Earth's shadow;</p> <p>bit 2: glint calculation not converging;</p> <p>bit 3: glint location sun vs. satellite zenith mismatch;</p> <p>bit 4: glint location sun vs. satellite azimuth mismatch;</p>

## A1-2. L1B AIRS QA Interface Specification

			bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECtoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECtoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ; bit 15: PGS_CSC_ECtoECR() returned any 'E' class return code
moongeoqa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit	None	TAI time at which instrument is nominally looking

## A1-2. L1B AIRS QA Interface Specification

	floating-point		directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
CalScanSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalFlag over the good channel list (see ExcludedChans). Zero means all "good" channels were well calibrated for this scanline bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: cold scene noise
CalFlag	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for the current scanline. Zero means the channel was well calibrated, for this scanline. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: cold scene noise
SpaceViewDelta	32-bit floating-point	Channel (= 2378)	The mean of the four spaceviews immediately following the Earth views in the scanline, minus the mean of the spaceviews immediately preceding the Earth views in the scanline (also the magnitude of a "pop" in this scanline, when the "pop detected" bit is set in CalFlag.) (data numbers)
spaceview_selection	8-bit unsigned integer	None	Indicates which footprints were included for this scan. Each bit is high when the corresponding space view is used in the spaceview offset calculation. (See L1B Processing Requirements, section 6.2); LSB is first space view.

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OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; bit 7 quicklook (expedited) flag; bits 8-11 submode bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag
DpCircCount	16-bit unsigned integer	None	Data Processing circumvention counts (active A or B) (counts)
DpCircBasThr	16-bit unsigned integer	None	Data Processing circumvention base threshold (active A or B)

Size: 1613925 bytes (1.6 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD;

## A1-2. L1B AIRS QA Interface Specification

			bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value; bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON; bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION; bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG; bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT; bit 8: (Sun) bad input value; bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value;

## A1-2. L1B AIRS QA Interface Specification

	integer		bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDEM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDEM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDEM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDEM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit	None	Fraction of spot that is land (0.0 ... 1.0)

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	floating-point		
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
Rdiff_swindow	32-bit floating-point	None	Radiance difference in the 2560 cm <sup>-1</sup> window region used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_swindow_M1a_chan) - radiance(Rdiff_swindow_M2a_chan). (radiance units)
Rdiff_lwindow	32-bit floating-point	None	Radiance difference in the longwave window(850 cm <sup>-1</sup> ) used to warn of possible errors caused by scene non-uniformity and misalignment of the beams: radiance(Rdiff_lwindow_M8_chan) - radiance(Rdiff_lwindow_M9_chan). (radiance units)
SceneInhomogeneous	8-bit unsigned integer	None	Threshold test for scene inhomogeneity, using band-overlap detectors (bit fields).; bit 7 (MSB, value 128): scene is inhomogeneous, as determined by the Rdiff_swindow threshold. For v4.0 the test is $\text{abs}(\text{Rdiff\_swindow}) > 5 * \sqrt{\text{NeN}(\text{Rdiff\_swindow\_M1a\_chan})^2 + \text{NeN}(\text{Rdiff\_swindow\_M2a\_chan})}$ ; bit 6 (value 64): scene is inhomogeneous, as determined by the Rdiff_lwindow threshold. For v4.0 the test is $\text{abs}(\text{Rdiff\_lwindow}) > 5 * \sqrt{\text{NeN}(\text{Rdiff\_lwindow\_M8\_chan})^2 + \text{NeN}(\text{Rdiff\_lwindow\_M9\_chan})}$ ; bits 5-0: unused (reserved)

Size: 716850 bytes (0.7 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
6408662 bytes (6.4 MB) per 45-scanset granule = 1538.1 MB per day**

### Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "input\_scene\_counts" involves reading HDF-EOS Swath field "input\_scene\_counts.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)

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dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

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## A1-3. L1B Visible/NIR Science Interface Specification

Interface Specification Version 4.0.9.0  
2005-02-01

ESDT ShortName = "AIRVBRAD"

Swath Name = "L1B\_VIS\_Science"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
SubTrack	9	VIS detector elements per AIRS footprint along track (9). Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
SubXTrack	8	VIS samples per AIRS footprint across track (8). Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
GeoLocationsPerSpot	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.
Channel	4	Dimension of channel array (Channel 1: ~0.40 micron; Ch 2: ~0.6 micron; Ch 3: ~0.8 micron; Ch 4: broadband)

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### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
VISDarkAMSUFOVCount	32-bit integer	Number of AMSU-A footprints that are uniformly dark in the level-1B VIS/NIR and are thus likely to be uniformly clear
VISBrightAMSUFOVCount	32-bit integer	Number of AMSU-A footprints that are uniformly bright in the level-1B VIS/NIR and are thus likely to be uniformly cloudy
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("VIS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing:

### A1-3. L1B Visible/NIR Science Interface Specification

		("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit	Time of eq_x_longitude in TAI units (floating-point

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	floating-point	elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	<p>Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline);</p> <p>bit 1: bad input value (first scanline);</p> <p>bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT;</p> <p>bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT;</p> <p>bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG;</p> <p>bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT;</p> <p>bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1;</p> <p>bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME;</p> <p>bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE;</p> <p>bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE;</p> <p>bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT;</p> <p>bit 25-31: not used</p>
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit	Number of scans with problems in glintgeoqa

### A1-3. L1B Visible/NIR Science Interface Specification

	integer	
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
VegMapFileName	string of 8-bit characters	Name of AVHRR input file used as Vegetation Map
limit_vis_det_temp	Color Counts (see below)	Input limit checking on Vis sensor array temperature
input_vis_det_temp	Limited Engineering Struct (see below)	Input statistics on Vis sensor array temperature
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
align_1_2_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 1 & 2
align_2_3_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 3
align_2_4_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 4
align_1_2_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 1 & 2
align_2_3_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 3
align_2_4_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90)

### A1-3. L1B Visible/NIR Science Interface Specification

		between VIS channels 2 & 4
align_vis_airs	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between the AIRS center and all VIS channels

Size: 351 bytes (0.0 MB) per granule

#### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
limit_scene_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on scene data numbers
limit_bb_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the blackbody (dark target)
limit_phot_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the photometric calibration source (bright target)
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on scene data numbers
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the blackbody (dark target)
input_phot_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the photometric calibration source (bright target)
limit_offsets	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Output limit checking on offsets
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offsets
offset_unc_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offset uncertainties
gain	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain: number of radiance units per count.
gain_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for gain (gain units).
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of radiances (radiance units)
NeN_stats	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of Noise-equivalent Radiance (NeN)
xtrack_err	32-bit floating-point	Channel (= 4)	cross-track pixel location error estimate per channel (km)
track_err	32-bit floating-point	Channel (= 4)	Along-track pixel location error estimate per channel (km)

Size: 26528 bytes (0.0 MB) per granule

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### Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
offset	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Offset: number of counts expected for no radiance at time nadirTAI
offset_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for offset (radiance units)
NeN	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Noise-equivalent Radiance (radiance units)
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned

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			<p>PGSTD_E_TIME_FMT_ERROR;  bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR;  bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS;  bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT;  bit 13: PGS_CSC_ECIttoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE;  bit 14: PGS_CSC_ECIttoECR() returned PGSCSC_E_BAD_ARRAY_SIZE;  bit 15: PGS_CSC_ECIttoECR() returned PGSTD_E_NO_LEAP_SECS;  bit 16: PGS_CSC_ECIttoECR() returned PGSTD_E_TIME_FMT_ERROR;  bit 17: PGS_CSC_ECIttoECR() returned PGSTD_E_TIME_VALUE_ERROR;  bit 18: unused (set to zero);  bit 19: PGS_CSC_ECIttoECR() returned PGSTD_E_NO_UT1_VALUE;  bit 20: PGS_CSC_ECIttoECR() returned PGS_E_TOOLKIT;  bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS;  bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE;  bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY;  bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING;  bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL;  bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL;  bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT;  bit 28-31: not used</p>
glintgeoqa	16-bit unsigned integer	None	<p>Glint Geolocation QA flags: bit 0 (LSB): bad input value;  bit 1: glint location in Earth's shadow;  bit 2: glint calculation not converging;  bit 3: glint location sun vs. satellite zenith mismatch;  bit 4: glint location sun vs. satellite azimuth mismatch;  bit 5: bad glint location;  bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code;  bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code;  bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code;  bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code;  bit 10: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint);</p>

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			bit 11: PGS_CSC_ECIttoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECIttoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ; bit 15: PGS_CSC_ECIttoECR() returned any 'E' class return code
moongeoqa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAltoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAltoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar

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glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
ViSnsrArrTemp	32-bit floating-point	None	Vis/NIR Sensor Array Temperature (Celcius)
ScHeadTemp1	32-bit floating-point	None	Scanner Head Housing Temperature 1 (active A or B) (Celcius)
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; bit 7 quicklook (expedited) flag; bits 8-11 submode bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag

Size: 67365 bytes (0.1 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
radiances	32-bit floating-point	Channel (= 4) * SubTrack (= 9) * SubXTrack (= 8)	Radiances for each channel in Watts/m**2/micron/steradian
PrelimCldQA	8-bit integer	None	Cloud QA index (0-good or 1-bad) -1 for not calculated
PrelimCldFracVis	32-bit floating-point	None	Cloud Fraction (0.0-1.0) -9999.0 for not calculated
PrelimCldFracVisErr	32-bit floating-point	None	Cloud Fraction Error (0.0-1.0) -9999.0 for not calculated
PrelimClrFracVis	32-bit floating-point	None	Clear Fraction (0.0-1.0) -9999.0 for not calculated
PrelimClrFracVisErr	32-bit floating-point	None	Clear Fraction Error (0.0-1.0) -9999.0 for not calculated
PrelimCldMapVis	8-bit integer	SubTrack (= 9) * SubXTrack (= 8)	Cloud Map (0-clear, 1-cloudy) -1 for not calculated
PrelimNDVI	32-bit floating-point	SubTrack (= 9) * SubXTrack (= 8)	Vegetation Index (-1.0 to 1.0) -999.0 for not calculated
bright_index	16-bit integer	None	Brightness index (1...5, 5 is brightest. -1 for not calculated)

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inhomo_index	16-bit integer	None	Inhomogeneity index (0...64, 1st digit NDVI-Dev, 2nd digit Ch1-Dev, -9999 for not calculated)
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value;

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	integer		<p>bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT;</p> <p>bit 8: (Sun) bad input value;</p> <p>bit 9: (suppressed)</p> <p>PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night);</p> <p>bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT</p>
demgeoqa	16-bit unsigned integer	None	<p>Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: Could not allocate memory;</p> <p>bit 2: Too close to North or South pole. Excluded;</p> <p>bit 3: Layer resolution incompatibility. Excluded;</p> <p>bit 4: Any DEM Routine (elev) returned PGSDem_E_IMPROPER_TAG;</p> <p>bit 5: Any DEM Routine (elev) returned PGSDem_E_CANNOT_ACCESS_DATA;</p> <p>bit 6: Any DEM Routine (land/water) returned PGSDem_E_IMPROPER_TAG;</p> <p>bit 7: Any DEM Routine (land/water) returned PGSDem_E_CANNOT_ACCESS_DATA;</p> <p>bit 8: Reserved for future layers;</p>

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			bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
cornerlats	32-bit floating-	GeoLocationsPerSpot (= 4) * Channel (= 4)	Geodetic Latitudes at the centers of the pixels at the corners of the IR footprint by

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	point		channel in degrees North (-90.0 ... 90.0)
cornerlons	32-bit floating-point	GeoLocationsPerSpot (= 4) * Channel (= 4)	Geodetic Longitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees East (-180.0 ... 180.0)

Size: 20788650 bytes (20.8 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
21174494 bytes (21.2 MB) per 45-scanset granule = 5081.9 MB per day**

### Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "input\_scene\_counts" involves reading HDF-EOS Swath field "input\_scene\_counts.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)

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max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Color Counts: This type tracks counts of values received during an interval by how they compare to corresponding "red" and "yellow" limits

Field Name	Type	Explanation
red_lo_limit	32-bit floating-point	Value of the low "red" limit.
red_lo_cnt	32-bit integer	Count of values less than the low "red" limit. This is an "Alarm" condition.
to_red_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_low".
yellow_lo_limit	32-bit floating-point	Value of the low "yellow" limit.
yellow_lo_cnt	32-bit integer	Count of values greater than the low "red" limit but less than the low "yellow" limit. This is a "Warning" condition.
to_yellow_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_low".
green_cnt	32-bit integer	Count of values greater than the low "yellow" limit but less than the high "yellow" limit.
to_green	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "green".
yellow_hi_limit	32-bit floating-point	Value of the high "yellow" limit.
yellow_hi_cnt	32-bit integer	Count of values greater than the high "yellow" limit but less than the high "red" limit. This is a "Warning" condition.
to_yellow_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_high".
red_hi_limit	32-bit floating-point	Value of the high "red" limit.
red_hi_cnt	32-bit integer	Count of values greater than the high "red" limit. This is an "Alarm" condition.
to_red_hi	32-bit integer	Count of occasions on which the "color" of this field changed from

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		some other value to "red_high".
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low limit (yellow_lo_limit) is missing; Bit 1 is high when yellow high limit is missing; Bit 2 is 1 when red low limit is missing; Bit 3 is 1 when red high limit is missing; Other bits unused set to 0.

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Interface Specification Version 4.0.9.0

2005-02-01

ESDT ShortName = "AIRVBQAP"

Swath Name = "L1B\_VIS\_QA"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
SubTrack	9	VIS detector elements per AIRS footprint along track (9). Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
SubXTrack	8	VIS samples per AIRS footprint across track (8). Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
GeoLocationsPerSpot	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.
Channel	4	Dimension of channel array (Channel 1: ~0.40 micron; Ch 2: ~0.6 micron; Ch 3: ~0.8 micron;

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Ch 4: broadband)

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("VIS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)

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start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned

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		PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
VegMapFileName	string of 8-bit characters	Name of AVHRR input file used as Vegetation Map
limit_vis_det_temp	Color Counts (see below)	Input limit checking on Vis sensor array temperature
input_vis_det_temp	Limited	Input statistics on Vis sensor array temperature

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	Engineering Struct (see below)	
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
align_1_2_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 1 & 2
align_2_3_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 3
align_2_4_nadir	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between VIS channels 2 & 4
align_1_2_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 1 & 2
align_2_3_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 3
align_2_4_maxang	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-limb AIRS footprints (1 & 90) between VIS channels 2 & 4
align_vis_airs	32-bit floating-point	Expected error (km) between the pixel locations for the corner locations of near-nadir AIRS footprints (45 & 46) between the AIRS center and all VIS channels

Size: 343 bytes (0.0 MB) per granule

### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
limit_scene_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on scene data numbers
limit_bb_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the blackbody (dark target)
limit_phot_counts	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Input limit checking on data numbers from the photometric calibration source (bright target)
input_scene_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on scene data numbers
input_bb_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the blackbody (dark target)
input_phot_counts	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Input statistics on data numbers from the photometric calibration source (bright target)

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limit_offsets	Color Counts (see below)	Channel (= 4) * SubTrack (= 9)	Output limit checking on offsets
offset_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offsets
offset_unc_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics on offset uncertainties
gain	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Gain: number of radiance units per count.
gain_err	32-bit floating-point	Channel (= 4) * SubTrack (= 9)	Error caused by imperfect fit for gain (gain units).
rad_stats	Unlimited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of radiances (radiance units)
NeN_stats	Limited Engineering Struct (see below)	Channel (= 4) * SubTrack (= 9)	Statistics over the granule of Noise-equivalent Radiance (NeN)
xtrack_err	32-bit floating-point	Channel (= 4)	cross-track pixel location error estimate per channel (km)
track_err	32-bit floating-point	Channel (= 4)	Along-track pixel location error estimate per channel (km)

Size: 26528 bytes (0.0 MB) per granule

### Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT;

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			<p>bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE;</p> <p>bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;</p> <p>bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED;</p> <p>bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT;</p> <p>bit 13: PGS_CSC_ECltoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 14: PGS_CSC_ECltoECR() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_ECltoECR() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 16: PGS_CSC_ECltoECR() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 17: PGS_CSC_ECltoECR() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 18: unused (set to zero);</p> <p>bit 19: PGS_CSC_ECltoECR() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_ECltoECR() returned PGS_E_TOOLKIT;</p> <p>bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS;</p> <p>bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE;</p> <p>bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY;</p> <p>bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING;</p> <p>bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL;</p> <p>bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL;</p> <p>bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT;</p> <p>bit 28-31: not used</p>
glintgeoqa	16-bit unsigned integer	None	<p>Glint Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: glint location in Earth's shadow;</p> <p>bit 2: glint calculation not converging;</p> <p>bit 3: glint location sun vs. satellite zenith mismatch;</p>

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			bit 4: glint location sun vs. satellite azimuth mismatch; bit 5: bad glint location; bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code; bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code; bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code; bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECItoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECItoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECItoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ; bit 15: PGS_CSC_ECItoECR() returned any 'E' class return code
moongeoa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit	None	TAI time at which instrument is nominally looking

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	floating-point		directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
ViSnrArrTemp	32-bit floating-point	None	Vis/NIR Sensor Array Temperature (Celcius)
ScHeadTemp1	32-bit floating-point	None	Scanner Head Housing Temperature 1 (active A or B) (Celcius)
OpMode	16-bit unsigned integer	None	Instrument Operations Mode. See AIRS Command Handbook, section 6.4 for a definition of each bit. bits 0 (LSB)-2 cal phase; bits 3-6 Cal Func; bit 7 quicklook (expedited) flag; bits 8-11 submode bits 12-14 Mode (0=standby, 1=ready, 2=operate, 3=checkout, 4=decontaminate, 5=off, 6=survival); bit 16 transition flag

Size: 9045 bytes (0.0 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the AIRS Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN;

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			<p>bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR;</p> <p>bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL;</p> <p>bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD;</p> <p>bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG;</p> <p>bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL;</p> <p>bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING;</p> <p>bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD;</p> <p>bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1;</p> <p>bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT;</p> <p>bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;</p> <p>bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 22-31: not used</p>
zengeoqa	16-bit unsigned integer	None	<p>Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value;</p> <p>bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT;</p> <p>bit 8: (Sun) bad input value;</p> <p>bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon</p>

#### A1-4. L1B Visible/NIR QA Interface Specification

			<p>at night);</p> <p>bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT</p>
demgeoqa	16-bit unsigned integer	None	<p>Digital Elevation Model (DEM) Geolocation QA flags:</p> <p>bit 0 (LSB): bad input value;</p> <p>bit 1: Could not allocate memory;</p> <p>bit 2: Too close to North or South pole. Excluded;</p> <p>bit 3: Layer resolution incompatibility. Excluded;</p> <p>bit 4: Any DEM Routine (elev) returned PGSDM_E_IMPROPER_TAG;</p> <p>bit 5: Any DEM Routine (elev) returned PGSDM_E_CANNOT_ACCESS_DATA;</p> <p>bit 6: Any DEM Routine (land/water) returned PGSDM_E_IMPROPER_TAG;</p> <p>bit 7: Any DEM Routine (land/water) returned PGSDM_E_CANNOT_ACCESS_DATA;</p> <p>bit 8: Reserved for future layers;</p> <p>bit 9: Reserved for future layers;</p> <p>bit 10: PGS_DEM_GetRegion(elev) returned PGSDM_M_FILLVALUE_INCLUDED;</p> <p>bit 11: PGS_DEM_GetRegion(land/water) returned PGSDM_M_FILLVALUE_INCLUDED;</p> <p>bit 12: Reserved for future layers;</p> <p>bit 13: PGS_DEM_GetRegion(all) returned PGSDM_M_MULTIPLE_RESOLUTIONS;</p> <p>bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1;</p> <p>bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code</p>
satzen	32-bit floating-point	None	<p>Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)</p>
satazi	32-bit floating-point	None	<p>Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)</p>
solzen	32-bit floating-point	None	<p>Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)</p>

## A1-4. L1B Visible/NIR QA Interface Specification

solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing

Size: 607500 bytes (0.6 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
935016 bytes (0.9 MB) per 45-scanset granule = 224.4 MB per day**

### Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "input\_scene\_counts" involves reading HDF-EOS Swath field "input\_scene\_counts.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.

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range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Color Counts: This type tracks counts of values received during an interval by how they compare to corresponding "red" and "yellow" limits

Field Name	Type	Explanation
red_lo_limit	32-bit floating-point	Value of the low "red" limit.
red_lo_cnt	32-bit integer	Count of values less than the low "red" limit. This is an "Alarm" condition.
to_red_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_low".
yellow_lo_limit	32-bit floating-point	Value of the low "yellow" limit.
yellow_lo_cnt	32-bit integer	Count of values greater than the low "red" limit but less than the low "yellow" limit. This is a "Warning" condition.
to_yellow_lo	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_low".
green_cnt	32-bit integer	Count of values greater than the low "yellow" limit but less than the

#### A1-4. L1B Visible/NIR QA Interface Specification

		high "yellow" limit.
to_green	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "green".
yellow_hi_limit	32-bit floating-point	Value of the high "yellow" limit.
yellow_hi_cnt	32-bit integer	Count of values greater than the high "yellow" limit but less than the high "red" limit. This is a "Warning" condition.
to_yellow_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "yellow_high".
red_hi_limit	32-bit floating-point	Value of the high "red" limit.
red_hi_cnt	32-bit integer	Count of values greater than the high "red" limit. This is an "Alarm" condition.
to_red_hi	32-bit integer	Count of occasions on which the "color" of this field changed from some other value to "red_high".
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low limit (yellow_lo_limit) is missing; Bit 1 is high when yellow high limit is missing; Bit 2 is 1 when red low limit is missing; Bit 3 is 1 when red high limit is missing; Other bits unused set to 0.

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Interface Specification Version 4.0.9.0  
2005-02-01

ESDT ShortName = "AIRABRAD"

Swath Name = "L1B\_AMSU"

Level = "level1B"

# Footprints = 30

# scanlines per scanset = 1

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields" have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	15	Dimension of channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 0.217 GHz Ch 11: f0 df 48 MHz; Ch 12: f0 df 22 MHz; Ch 13: f0 df 10 MHz; Ch 14: f0 df 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
CalXTrack	4	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_AMSU_CALIB) (Footprints are ordered: 1-2: spaceviews; 3-4: blackbody radiometric calibration source)
SpaceXTrack	2	Dimension "across" track for spaceview calibration footprint positions in

## A1-5. L1B AMSU-A Interface Specification

		order of observation time. (NUM_FOOTPRINTS_AMSU_SPACE)
BBXTrack	2	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_AMSU_BB)
WarmPRTA11	5	Number of PRTs measuring AMSU-A1-1 warm target (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
WarmPRTA12	5	Number of PRTs measuring AMSU-A1-2 warm target (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
WarmPRTA2	7	Number of PRTs measuring AMSU-A2 warm target (AMSU-A2 is AMSU-A channels 1 & 2)

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 32400 bytes (0.0 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AMSU-A")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected channels * scene FOVs
NumProcessData	32-bit integer	Number of channels * scene FOVs which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of channels * scene FOVs which are present and can be processed only as a special test (state = 1)

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NumBadData	32-bit integer	Number of channels * scene FOVs which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected channels * scene FOVs which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit	Geodetic Longitude of spacecraft at start of

# A1-5. L1B AMSU-A Interface Specification

	floating-point	granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE;

## A1-5. L1B AMSU-A Interface Specification

		bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_scanlines_not_norm_mode_a1	32-bit integer	Number of scanlines not in Process state (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_scanlines_not_norm_mode_a2	32-bit integer	Number of scanlines not in Process state (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_missing_scanlines_a1	32-bit integer	Number of scanlines with state = missing (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_missing_scanlines_a2	32-bit integer	Number of scanlines with state = missing (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)

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num_data_gaps_a1	32-bit integer	Number of blocks of scanlines where State is not Process (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_data_gaps_a2	32-bit integer	Number of blocks of scanlines where State is not Process (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_instr_mode_changes_a1	32-bit integer	Number of operational instrument mode changes (AMSU-A1) (AMSU-A1 is AMSU-A channels 3-15)
num_instr_mode_changes_a2	32-bit integer	Number of operational instrument mode changes (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_scanlines_rec_cal_prob_a11	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
num_scanlines_rec_cal_prob_a12	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
num_scanlines_rec_cal_prob_a2	32-bit integer	Number of scanlines with non-zero qa_receiver (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2)
num_scanlines_sig_coast_xing	32-bit integer	Number of scanlines with qa_scanline coast crossing bit set
num_scanlines_sig_sun_glint	32-bit integer	Number of scanlines with qa_scanline sun glint bit set
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in the AMSU-A1 space view plus number of scanlines in granule with the moon in the AMSU-A2 space view (0-90)
QA_bb_PRT_a11	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
QA_bb_PRT_a12	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
QA_bb_PRT_a2	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
QA_rec_PRT_a11	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A1-1) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
QA_rec_PRT_a12	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A1-2) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)

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QA_rec_PRT_a2	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (AMSU-A2) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Size: 710 bytes (0.0 MB) per granule

### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
center_freq	32-bit floating-point	Channel (= 15)	Channel Center frequency (GHz)
IF_offset_1	32-bit floating-point	Channel (= 15)	Offset of first intermediate frequency stage (MHz) (zero for no mixing)
IF_offset_2	32-bit floating-point	Channel (= 15)	Offset of second intermediate frequency stage (MHz) (zero for no second mixing)
bandwidth	32-bit floating-point	Channel (= 15)	bandwidth of sum of 1, 2, or 4 channels (MHz)
num_calibrated_scanlines	32-bit integer	Channel (= 15)	Number of scanlines that had calibration coefs applied
num_scanlines_ch_cal_problems	32-bit integer	Channel (= 15)	Number of scanlines with non-zero qa_channel
QA_unfiltered_scene_count	Unlimited Engineering Struct (see below)	GeoXTrack (= 30) * Channel (= 15)	Per footprint position raw scene count summary QA
QA_unfiltered_BB_count	Unlimited Engineering Struct (see below)	BBXTrack (= 2) * Channel (= 15)	Per BB footprint position raw warm count summary QA (unfiltered)
QA_unfiltered_space_count	Unlimited Engineering Struct (see below)	SpaceXTrack (= 2) * Channel (= 15)	Per space footprint position raw cold count summary QA (unfiltered)
QA_cal_coef_a0	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a0 summary QA (K)
QA_cal_coef_a1	Unlimited Engineering	Channel (= 15)	Calibration coefficient a1 summary QA (K/count)

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	Struct (see below)		
QA_cal_coef_a2	Unlimited Engineering Struct (see below)	Channel (= 15)	Calibration coefficient a2 summary QA (K/count**2)
QA_bb_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on differences between warm cal counts, $DT=ABS(T1-T2)/SQRT(2)$
QA_sv_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on differences between cold cal counts, $DT=ABS(T1-T2)/SQRT(2)$
QA_NeDT	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on gain * differences between warm cal counts (K)
QA_NeDT2NomRatio	Unlimited Engineering Struct (see below)	Channel (= 15)	Summary QA on gain * differences between warm cal counts over nominal NeDT (unitless)

Size: 34800 bytes (0.0 MB) per granule

## Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the (roll) ORB axis, axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about (pitch) ORB axis. axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about (yaw) axis. axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT;

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			bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECltoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECltoECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECltoECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECltoECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECltoECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECltoECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECltoECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: glint location in Earth's shadow; bit 2: glint calculation not converging; bit 3: glint location sun vs. satellite zenith

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			<p>mismatch;  bit 4: glint location sun vs. satellite azimuth mismatch;  bit 5: bad glint location;  bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code;  bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code;  bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code;  bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code;  bit 10: PGS_CSC_ECltoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint);  bit 11: PGS_CSC_ECltoECR() returned any 'E' class return code (for Glint);  bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint);  bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint);  bit 14: PGS_CSC_ECltoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ;  bit 15: PGS_CSC_ECltoECR() returned any 'E' class return code</p>
moongeoqa	16-bit unsigned integer	None	<p>Moon Geolocation QA flags: bit 0 (LSB): bad input value;  bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS;  bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT;  bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE;  bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR;  bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE;  bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID;  bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY;  bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE;  bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME;  bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE;  bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN;  bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;  bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE;  bit 14: PGS_CBP_Sat_CB_Vector() returned</p>

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			PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating- point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating- point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating- point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating- point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating- point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
state1	32-bit integer	None	Data state for AMSU-A1: 0:Process, 1:Special, 2:Erroneous, 3:Missing
state2	32-bit integer	None	Data state for AMSU-A2: 0:Process, 1:Special, 2:Erroneous, 3:Missing (AMSU-A2 is AMSU-A channels 1 and 2)
cal_coef_a0	32-bit floating- point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K)
cal_coef_a1	32-bit floating- point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K/count)
cal_coef_a2	32-bit floating- point	Channel (= 15)	Calibration coefficients to convert raw counts to antenna temperature (K/count**2)
cal_coef_a0_err	32-bit floating- point	Channel (= 15)	Error estimate for cal_coef_a0 (K)
cal_coef_a1_err	32-bit floating- point	Channel (= 15)	Error estimate for cal_coef_a1 (K/count)
cal_coef_a2_err	32-bit floating- point	Channel (= 15)	Error estimate for cal_coef_a2 (K/count**2)
a1_ColdCalPstion	8-bit integer	None	AMSU-A1 Cold Calibration Position 1-4 (Binary 0-3)
a2_ColdCalPstion	8-bit integer	None	AMSU-A2 Cold Calibration Position 1-4 (Binary 0-3) (AMSU-A2 is AMSU-A channels 1 and 2)
a1_PLO_Redundncy	8-bit	None	AMSU-A1 PLO Redundancy, 1: default (PLO 2);

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	integer		0: redundant (PLO 1)
a11_mux_temp_used	8-bit integer	None	AMSU-A1-1 MUX Temperature use flag. (1: used MUX temperature for AMSU-A1 receiver temperature; 0: used RF shelf temperature) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15)
a11_receiver_temp	32-bit floating-point	None	AMSU-A1-1 receiver temperature used in calibration (MUX temperature or RF shelf temperature as specified by a11_mux_temp_used) (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
a11_target_temp	32-bit floating-point	None	AMSU-A1-1 target temperature used in calibration (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15) (C)
a12_mux_temp_used	8-bit integer	None	AMSU-A1-2 MUX Temperature use flag. (1: used MUX temperature for AMSU-A1 receiver temperature; 0: used RF shelf temperature) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8)
a12_receiver_temp	32-bit floating-point	None	AMSU-A1-2 receiver temperature used in calibration (MUX temperature or RF shelf temperature as specified by a12_mux_temp_used) (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
a12_target_temp	32-bit floating-point	None	AMSU-A1-2 target temperature used in calibration (AMSU-A1-2 is AMSU-A channels 3, 4, 5, and 8) (C)
a2_diplexer_temp_used	8-bit integer	None	AMSU-A2 diplexer Temperature use flag. (1: used diplexer temperature for AMSU-A2 receiver temperature; 0: used RF shelf temperature) (AMSU-A2 is AMSU-A channels 1 and 2)
a2_receiver_temp	32-bit floating-point	None	AMSU-A2 receiver temperature used in calibration (diplexer temperature or RF shelf temperature as specified by a2_mux_temp_used) (AMSU-A2 is AMSU-A channels 1 and 2) (C)
a2_target_temp	32-bit floating-point	None	AMSU-A2 target temperature used in calibration (AMSU-A2 is AMSU-A channels 1 and 2) (C)
qa_scanline	8-bit unsigned integer	None	Scanline bitmap for AMSU-A: Bit 0: Sun glint in this scanline; Bit 1: Coastal crossing in this scanline; Bit 2: Some channels had excessive NeDT estimate; Bit 3: Near sidelobe correction applied
qa_receiver_a11	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-1 (AMSU-A1-1 is AMSU-A channels 6, 7, 9-15): Bit 0: Calibration was not derived, due to the instrument mode; Bit 1: Calibration was not derived, due to bad or missing PRT values;

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			Bit 2: This scanline was calibrated, but the moon was in the space view; Bit 3: This scanline was calibrated, but there was a space view scan position err; Bit 4: This scanline was calibrated, but there was a blackbody scan position error; Bit 5: This scanline was calibrated, but some PRT values were bad or marginal; Bit 6: This scanline was calibrated, but there was a data gap; Bit 7: Some channels were not calibrated
qa_receiver_a12	8-bit unsigned integer	None	Receiver bitmap for AMSU-A1-2: Same fields as defined for qa_receiver_a11
qa_receiver_a2	8-bit unsigned integer	None	Receiver bitmap for AMSU-A2: Same fields as defined for qa_receiver_a11
qa_channel	8-bit unsigned integer	Channel (= 15)	Channel bitmap for AMSU-A: Bit 0: All space view counts were bad for this channel and scanline; Bit 1: Space view counts were marginal for this channel and scanline; Bit 2: Space view counts could not be smoothed; Bit 3: All blackbody counts were bad for this channel and scanline; Bit 4: Blackbody counts were marginal for this channel and scanline; Bit 5: Blackbody counts could not be smoothed; Bit 6: Unable to calculate calibration coefficients for this scanline, most recent valid coefficients used instead; Bit 7: Excessive NeDT estimated

Size: 21330 bytes (0.0 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of AMSU-A instrument with respect to the AMSU-A Instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR;

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			<p>bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL;</p> <p>bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD;</p> <p>bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG;</p> <p>bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL;</p> <p>bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING;</p> <p>bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD;</p> <p>bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1;</p> <p>bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT;</p> <p>bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;</p> <p>bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 22-31: not used</p>
zengeoqa	16-bit unsigned integer	None	<p>Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value;</p> <p>bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT;</p> <p>bit 8: (Sun) bad input value;</p> <p>bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night);</p> <p>bit 10: PGS_CSC_ZenithAzimuth(Sun) returned</p>

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			PGSCSC_W_UNDEFINED_AZIMUTH; bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION; bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG; bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE; bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR; bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: Could not allocate memory; bit 2: Too close to North or South pole. Excluded; bit 3: Layer resolution incompatibility. Excluded; bit 4: Any DEM Routine (elev) returned PGSDEM_E_IMPROPER_TAG; bit 5: Any DEM Routine (elev) returned PGSDEM_E_CANNOT_ACCESS_DATA; bit 6: Any DEM Routine (land/water) returned PGSDEM_E_IMPROPER_TAG; bit 7: Any DEM Routine (land/water) returned PGSDEM_E_CANNOT_ACCESS_DATA; bit 8: Reserved for future layers; bit 9: Reserved for future layers; bit 10: PGS_DEM_GetRegion(elev) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 11: PGS_DEM_GetRegion(land/water) returned PGSDEM_M_FILLVALUE_INCLUDED; bit 12: Reserved for future layers; bit 13: PGS_DEM_GetRegion(all) returned PGSDEM_M_MULTIPLE_RESOLUTIONS; bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1; bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code
satzen	32-bit floating- point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating- point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating- point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)

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	point		
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
antenna_temp	32-bit floating-point	Channel (= 15)	Raw antenna temperature in Kelvins
brightness_temp	32-bit floating-point	Channel (= 15)	Sidelobe-corrected antenna temperatures in Kelvins
brightness_temp_err	32-bit floating-point	Channel (= 15)	Error in brightness_temp (K)

Size: 305100 bytes (0.3 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
394340 bytes (0.4 MB) per 45-scanset granule = 94.6 MB per day**

### Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "QA\_bb\_PRT\_a11" involves reading HDF-EOS Swath field "QA\_bb\_PRT\_a11.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule
num_lo	32-bit integer	Count of out-of-range low values field takes on in granule

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num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

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## A1-6. L1B HSB Interface Specification

Interface Specification Version 4.0.9.0  
2005-02-01

ESDT ShortName = "AIRHBRAD"

Swath Name = "L1B\_HSB"

Level = "level1B"

# Footprints = 90

# scanlines per scanset = 3

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	90	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	5	Dimension of channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 1.0 GHz; Ch 4: f0 3.0 GHz; Ch 5: f0 7.0 GHz (f0 = 183.31 GHz))
CalXTrack	8	Dimension "across" track for calibration footprint positions. Same as number of calibration footprints per scanline. (NUM_FOOTPRINTS_HSB_CALIB) (Footprints are ordered: 1-4: spaceviews; 5-8: blackbody radiometric calibration source)
SpaceXTrack	4	Dimension "across" track for spaceview calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_HSB_SPACE)
BBXTrack	4	Dimension "across" track for blackbody calibration footprint positions in order of observation time. (NUM_FOOTPRINTS_HSB_BB)
WarmPRT	7	Number of PRTs measuring warm target

## A1-6. L1B HSB Interface Specification

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 291600 bytes (0.3 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level1B")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("HSB")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected channels * scene FOVs
NumProcessData	32-bit integer	Number of channels * scene FOVs which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of channels * scene FOVs which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of channels * scene FOVs which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected channels * scene FOVs which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land

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node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)

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end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned

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		PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glntgeoqa	16-bit integer	Number of scans with problems in glntgeoqa
num_moongoqa	16-bit integer	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
num_scanlines_not_norm_mode	32-bit integer	Number of scanlines not in Process state
num_missing_scanlines	32-bit integer	Number of scanlines with state = missing
num_data_gaps	32-bit integer	Number of blocks of scanlines where State is not Process
num_instr_mode_changes	32-bit integer	Number of operational instrument mode changes
num_scanlines_rec_cal_prob	32-bit integer	Number of scanlines with non-zero qa_receiver
num_scanlines_sig_coast_xing	32-bit integer	Number of scanlines with qa_scanline coast crossing bit set
num_scanlines_sig_sun_glnt	32-bit integer	Number of scanlines with qa_scanline sun glint bit set
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in the HSB space view
QA_bb_PRT	Limited Engineering Struct (see below)	Blackbody PRT temperature summary QA (C)

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QA_rec_PRT	Limited Engineering Struct (see below)	Receiver PRT temperature summary QA (C)
granules_present	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Size: 366 bytes (0.0 MB) per granule

### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
center_freq	32-bit floating-point	Channel (= 5)	Channel Center frequency (GHz)
IF_offset_1	32-bit floating-point	Channel (= 5)	Offset of first intermediate frequency stage (MHz) (zero for no mixing)
IF_offset_2	32-bit floating-point	Channel (= 5)	Offset of second intermediate frequency stage (MHz) (zero for no second mixing)
bandwidth	32-bit floating-point	Channel (= 5)	Bandwidth of sum of 1, 2, or 4 channels (MHz)
num_calibrated_scanlines	32-bit integer	Channel (= 5)	Number of scanlines that had calibration coefs applied
num_scanlines_ch_cal_problems	32-bit integer	Channel (= 5)	Number of scanlines with non-zero qa_channel
QA_unfiltered_scene_count	Unlimited Engineering Struct (see below)	GeoXTrack (= 90) * Channel (= 5)	Per footprint position raw scene count summary QA
QA_unfiltered_BB_count	Unlimited Engineering Struct (see below)	BBXTrack (= 4) * Channel (= 5)	Per BB footprint position raw warm count summary QA (unfiltered)
QA_unfiltered_space_count	Unlimited Engineering Struct (see below)	SpaceXTrack (= 4) * Channel (= 5)	Per space footprint position raw cold count summary QA (unfiltered)
QA_cal_coef_a0	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a0 summary QA (K)
QA_cal_coef_a1	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a1 summary QA (K/count)

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	below)		
QA_cal_coef_a2	Unlimited Engineering Struct (see below)	Channel (= 5)	Calibration coefficient a2 summary QA (K/count**2)
QA_bb_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on differences between warm cal counts, $DT=ABS(T1-T2)/SQRT(2)$
QA_sv_raw_noise_counts	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on differences between cold cal counts, $DT=ABS(T1-T2)/SQRT(2)$
QA_NeDT	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on gain * differences between warm cal counts (K)
QA_NeDT2NomRatio	Unlimited Engineering Struct (see below)	Channel (= 5)	Summary QA on gain * differences between warm cal counts over nominal NeDT (unitless)

Size: 29520 bytes (0.0 MB) per granule

### Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the (roll) ORB axis, axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about (pitch) ORB axis. axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about (yaw) axis. axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned

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			<p>PGSEPH_W_BAD_EPHEM_VALUE;  bit 4: PGS_EPH_EphemAttit() returned  PGSEPH_E_BAD_EPHEM_FILE_HDR;  bit 5: PGS_EPH_EphemAttit() returned  PGSEPH_E_NO_SC_EPHEM_FILE;  bit 6: PGS_EPH_EphemAttit() returned  PGSEPH_E_NO_DATA_REQUESTED;  bit 7: PGS_EPH_EphemAttit() returned  PGSTD_E_SC_TAG_UNKNOWN;  bit 8: PGS_EPH_EphemAttit() returned  PGSEPH_E_BAD_ARRAY_SIZE;  bit 9: PGS_EPH_EphemAttit() returned  PGSTD_E_TIME_FMT_ERROR;  bit 10: PGS_EPH_EphemAttit() returned  PGSTD_E_TIME_VALUE_ERROR;  bit 11: PGS_EPH_EphemAttit() returned  PGSTD_E_NO_LEAP_SECS;  bit 12: PGS_EPH_EphemAttit() returned  PGS_E_TOOLKIT;  bit 13: PGS_CSC_ECIttoECR() returned  PGSCSC_W_BAD_TRANSFORM_VALUE;  bit 14: PGS_CSC_ECIttoECR() returned  PGSCSC_E_BAD_ARRAY_SIZE;  bit 15: PGS_CSC_ECIttoECR() returned  PGSTD_E_NO_LEAP_SECS;  bit 16: PGS_CSC_ECIttoECR() returned  PGSTD_E_TIME_FMT_ERROR;  bit 17: PGS_CSC_ECIttoECR() returned  PGSTD_E_TIME_VALUE_ERROR;  bit 18: unused (set to zero);  bit 19: PGS_CSC_ECIttoECR() returned  PGSTD_E_NO_UT1_VALUE;  bit 20: PGS_CSC_ECIttoECR() returned  PGS_E_TOOLKIT;  bit 21: PGS_CSC_ECRtoGEO() returned  PGSCSC_W_TOO_MANY_ITERS;  bit 22: PGS_CSC_ECRtoGEO() returned  PGSCSC_W_INVALID_ALTITUDE;  bit 23: PGS_CSC_ECRtoGEO() returned  PGSCSC_W_SPHERE_BODY;  bit 24: PGS_CSC_ECRtoGEO() returned  PGSCSC_W_LARGE_FLATTENING;  bit 25: PGS_CSC_ECRtoGEO() returned  PGSCSC_W_DEFAULT_EARTH_MODEL;  bit 26: PGS_CSC_ECRtoGEO() returned  PGSCSC_E_BAD_EARTH_MODEL;  bit 27: PGS_CSC_ECRtoGEO() returned  PGS_E_TOOLKIT;  bit 28-31: not used</p>
glintgeoqa	16-bit unsigned integer	None	<p>Glnt Geolocation QA flags: bit 0 (LSB): bad input  value;  bit 1: glint location in Earth's shadow;  bit 2: glint calculation not converging;  bit 3: glint location sun vs. satellite zenith  mismatch;</p>

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			<p>bit 4: glint location sun vs. satellite azimuth mismatch;</p> <p>bit 5: bad glint location;</p> <p>bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code;</p> <p>bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code;</p> <p>bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code;</p> <p>bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code;</p> <p>bit 10: PGS_CSC_ECltoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint);</p> <p>bit 11: PGS_CSC_ECltoECR() returned any 'E' class return code (for Glint);</p> <p>bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint);</p> <p>bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint);</p> <p>bit 14: PGS_CSC_ECltoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ;</p> <p>bit 15: PGS_CSC_ECltoECR() returned any 'E' class return code</p>
moongeoqa	16-bit unsigned integer	None	<p>Moon Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT;</p> <p>bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE;</p> <p>bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR;</p> <p>bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE;</p> <p>bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID;</p> <p>bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE;</p> <p>bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME;</p> <p>bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE;</p> <p>bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;</p> <p>bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT;</p>

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			bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
state	32-bit integer	None	Data state: 0:Process, 1:Special, 2:Erroneous, 3:Missing
cal_coef_a0	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K)
cal_coef_a1	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K/count)
cal_coef_a2	32-bit floating-point	Channel (= 5)	Calibration coefficients to convert raw counts to antenna temperature (K/count**2)
cal_coef_a0_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a0 (K)
cal_coef_a1_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a1 (K/count)
cal_coef_a2_err	32-bit floating-point	Channel (= 5)	Error estimate for cal_coef_a2 (K/count**2)
SpacViewSelct	8-bit integer	None	Space View Selected
mixer_17_temp_used	8-bit integer	None	Mixer 17 Temperature use flag. (1: used mixer 17 temperature for receiver temperature; 0: used mixer 18/19/20 temperature)
receiver_temp	32-bit floating-point	None	Receiver temperature used in calibration (mixer 17 temperature or mixer 18/19/20 temperature as specified by mixer_17_temp_used) (C)
target_temp	32-bit	None	HSB target temperature used in calibration (C)

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	floating-point		
qa_scanline	8-bit unsigned integer	None	Scanline bitmap for HSB: Bit 0: Sun glint in this scanline; Bit 1: Coastal crossing in this scanline; Bit 2: Some channels had excessive NeDT estimate; Bit 3: Near sidelobe correction applied
qa_receiver	8-bit unsigned integer	None	Receiver bitmap for HSB: Bit 0: Calibration was not derived, due to the instrument mode; Bit 1: Calibration was not derived, due to bad or missing PRT values; Bit 2: This scanline was calibrated, but the moon was in the space view; Bit 3: This scanline was calibrated, but there was a space view scan position err; Bit 4: This scanline was calibrated, but there was a blackbody scan position error; Bit 5: This scanline was calibrated, but some PRT values were bad or marginal; Bit 6: This scanline was calibrated, but there was a data gap; Bit 7: Some channels were not calibrated
qa_channel	8-bit unsigned integer	Channel (= 5)	Channel bitmap for HSB: Bit 0: All space view counts were bad for this channel and scanline; Bit 1: Space view counts were marginal for this channel and scanline; Bit 2: Space view counts could not be smoothed; Bit 3: All blackbody counts were bad for this channel and scanline; Bit 4: Blackbody counts were marginal for this channel and scanline; Bit 5: Blackbody counts could not be smoothed; Bit 6: Most recent calibration coefficients used; Bit 7: Excessive NeDT estimated

Size: 26730 bytes (0.0 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
scanang	32-bit floating-point	None	Scanning angle of HSB instrument with respect to the HSB instrument for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned

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			<p>PGSTD_E_SC_TAG_UNKNOWN;  bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR;  bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL;  bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD;  bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG;  bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE;  bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL;  bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING;  bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD;  bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY;  bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS;  bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR;  bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR;  bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1;  bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE;  bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT;  bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;  bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE;  bit 22-31: not used</p>
zengeoqa	16-bit unsigned integer	None	<p>Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value;  bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON;  bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH;  bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION;  bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG;  bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;  bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR;  bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT;  bit 8: (Sun) bad input value;  bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is</p>

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			<p>not an error condition - the sun is below the horizon at night);</p> <p>bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT</p>
demgeoqa	16-bit unsigned integer	None	<p>Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: Could not allocate memory;</p> <p>bit 2: Too close to North or South pole. Excluded;</p> <p>bit 3: Layer resolution incompatibility. Excluded;</p> <p>bit 4: Any DEM Routine (elev) returned PGSDM_E_IMPROPER_TAG;</p> <p>bit 5: Any DEM Routine (elev) returned PGSDM_E_CANNOT_ACCESS_DATA;</p> <p>bit 6: Any DEM Routine (land/water) returned PGSDM_E_IMPROPER_TAG;</p> <p>bit 7: Any DEM Routine (land/water) returned PGSDM_E_CANNOT_ACCESS_DATA;</p> <p>bit 8: Reserved for future layers;</p> <p>bit 9: Reserved for future layers;</p> <p>bit 10: PGS_DEM_GetRegion(elev) returned PGSDM_M_FILLVALUE_INCLUDED;</p> <p>bit 11: PGS_DEM_GetRegion(land/water) returned PGSDM_M_FILLVALUE_INCLUDED;</p> <p>bit 12: Reserved for future layers;</p> <p>bit 13: PGS_DEM_GetRegion(all) returned PGSDM_M_MULTIPLE_RESOLUTIONS;</p> <p>bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1;</p> <p>bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code</p>
satzen	32-bit floating-point	None	<p>Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)</p>
satazi	32-bit floating-point	None	<p>Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)</p>
solzen	32-bit floating-point	None	<p>Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)</p>

## A1-6. L1B HSB Interface Specification

solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
antenna_temp	32-bit floating-point	Channel (= 5)	Raw antenna temperature in Kelvins
brightness_temp	32-bit floating-point	Channel (= 5)	Sidelobe-corrected antenna temperatures in Kelvins
brightness_temp_err	32-bit floating-point	Channel (= 5)	Error in brightness_temp (K)

Size: 1287900 bytes (1.3 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
1636116 bytes (1.6 MB) per 45-scanset granule = 392.7 MB per day**

### Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "min" of AIRS field "QA\_bb\_PRT" involves reading HDF-EOS Swath field "QA\_bb\_PRT.min".

Limited Engineering Struct: This type is used for engineering data fields for which there are known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num_in = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num_in = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num_in = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num_in < 2)
num_in	32-bit integer	Count of in-range values field takes on in granule

## A1-6. L1B HSB Interface Specification

num_lo	32-bit integer	Count of out-of-range low values field takes on in granule
num_hi	32-bit integer	Count of out-of-range high values field takes on in granule
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
range_min	32-bit floating-point	Minimum in-range value.
range_max	32-bit floating-point	Maximum in-range value.
missing	8-bit integer	Missing limits flags. Bit 0 (LSB) is 1 when yellow low (range_min) limit is missing; Bit 1 is high when yellow high (range_max) limit is missing; other bits unused, set to 0.
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

Unlimited Engineering Struct: This type is used for engineering data fields for which there are NOT known "yellow" limits

Field Name	Type	Explanation
min	32-bit floating-point	Minimum value field takes on in granule (not valid when num = 0)
max	32-bit floating-point	Maximum value field takes on in granule (not valid when num = 0)
mean	32-bit floating-point	Mean of values field takes on in granule (not valid when num = 0)
dev	32-bit floating-point	Standard Deviation of values field takes on in granule (not valid when num < 2)
num	32-bit integer	Count of occurrences of field in granule (not including those counted in num_bad)
num_bad	32-bit integer	Count of occasions on which field takes on invalid flag value (-9999) in granule
max_track	32-bit integer	GeoTrack index (counting from 1) where max was found
max_xtrack	32-bit integer	GeoXTrack index (counting from 1) where max was found
min_track	32-bit integer	GeoTrack index (counting from 1) where min was found
min_xtrack	32-bit integer	GeoXTrack index (counting from 1) where min was found

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## A1-7. L2 Standard Atmospheric/Surface Product Interface Specification

Interface Specification Version 4.0.9.0

2005-02-01

ESDT ShortName = "AIRX2RET"

Swath Name = "L2\_Standard\_atmospheric&surface\_product"

Level = "level2"

# Footprints = 30

# scanlines per scanset = 1

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
StdPressureLev	28	Number of standard pressure altitude levels (from bottom of the atmosphere up); nSurfStd is the 1-based index of the first valid level for a given profile. Any levels before this are below the surface. Since the actual surface will not be exactly at this level, it will be necessary to extrapolate or interpolate to get precise surface values. See entries for specific fields for more details.
StdPressureLay	28	Number of standard pressure altitude layers (Always equal to StdPressureLev: last layer goes to the top of the atmosphere); nSurfStd is the 1-based index of the first valid layer for a given profile. Any layers before this are below the surface. Since the actual surface will not be exactly at the bottom of this layer, it will be necessary to extrapolate or interpolate to get total amounts for surface layers. See entries for specific fields for more details.
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is

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		the same as GeoTrack -- parallel to the satellite's path, increasing with time
Cloud	2	Cloud layer dimension in order of increasing pressure. Only first numCloud elements are valid
ChanAMSUA	15	Dimension of AMSU-A Channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
ChanHSB	5	Dimension of HSB Channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz (f0 = 183.31 GHz))
MWHingeSurf	7	Number of standard frequency hinge points in Microwave surface emissivity and surface brightness. Frequencies are 23.8, 31.4, 50.3, 52.8, 89.0, 150.0, 183.31 GHz respectively. Values are also found in field MWHingeSurfFreqGHz.
HingeSurf	100	Maximum number of frequency hinge points in IR surface emissivity

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 32400 bytes (0.0 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level2")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-	Zero-terminated character string set to "Night" when the

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	bit characters	subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit	Orbit row at start of granule (1 ... 248 as defined by EOS)

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	integer	project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned

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		PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT; bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongoqa	16-bit integer	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
granules_present	string of 8-	Zero-terminated character string denoting which adjacent

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	bit characters	granules were available for precipitation ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)
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Size: 174 bytes (0.0 MB) per granule

### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
pressStd	32-bit floating-point	StdPressureLev (= 28)	Standard pressures in mbar (bottom of the atmosphere first)
MWHingeSurfFreqGHz	32-bit floating-point	MWHingeSurf (= 7)	Frequencies in GHz for MW surface parameters (SfcTbMWStd, EmisMWStd,...)

Size: 140 bytes (0.0 MB) per granule

### Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED;

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			<p>bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT;</p> <p>bit 13: PGS_CSC_ECItoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 14: PGS_CSC_ECItoECR() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_ECItoECR() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 16: PGS_CSC_ECItoECR() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 17: PGS_CSC_ECItoECR() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 18: unused (set to zero);</p> <p>bit 19: PGS_CSC_ECItoECR() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_ECItoECR() returned PGS_E_TOOLKIT;</p> <p>bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS;</p> <p>bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE;</p> <p>bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY;</p> <p>bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING;</p> <p>bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL;</p> <p>bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL;</p> <p>bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT;</p> <p>bit 28-31: not used</p>
glintgeoqa	16-bit unsigned integer	None	<p>Glint Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: glint location in Earth's shadow;</p> <p>bit 2: glint calculation not converging;</p> <p>bit 3: glint location sun vs. satellite zenith mismatch;</p> <p>bit 4: glint location sun vs. satellite azimuth mismatch;</p> <p>bit 5: bad glint location;</p> <p>bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code;</p> <p>bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code;</p> <p>bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code;</p>

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			bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code; bit 10: PGS_CSC_ECItoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); bit 11: PGS_CSC_ECItoECR() returned any 'E' class return code (for Glint); bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint); bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint); bit 14: PGS_CSC_ECItoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ; bit 15: PGS_CSC_ECItoECR() returned any 'E' class return code
moongeoa	16-bit unsigned integer	None	Moon Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAItoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAItoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE; bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR; bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE; bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID; bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY; bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME; bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit	None	Satellite geodetic longitude in degrees East (-180.0 ...

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	floating-point		180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating-point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)

Size: 2565 bytes (0.0 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
RetQAFlag	16-bit unsigned integer	None	<p>Retrieval QA flags: users are advised not to use unless all bits are zero. bit 15: spare, set to zero.;</p> <p>bit 14 (value 16384): Ozone retrieval is suspect or rejected. (see Qual_O3 for details);</p> <p>bit 13 (value 8192): Water vapor retrieval is suspect or rejected. (see Qual_H2O for details);</p> <p>bit 12 (value 4096): Top part of temperature profile quality check failed or not attempted. (above Press_mid_top_bndry mbar, indices nStd_mid_top_bndry and nSup_mid_top_bndry; see Qual_Temp_Profile_Top for details);</p> <p>bit 11 (value 2048): Middle part of temperature profile quality check failed or not attempted. (between Press_bot_mid_bndry and Press_top_mid_bndry mbar, indices nStd_bot_mid_bndry, nSup_bot_mid_bndry, nStd_bot_mid_bndry, and nSup_bot_mid_bndry; see Qual_Temp_Profile_Mid for details);</p> <p>bit 10 (value 1024): Bottom part of temperature profile quality check failed or not attempted. (below Press_bot_mid_bndry mbar, indices nStd_bot_mid_bndry and nSup_bot_mid_bndry; see Qual_Temp_Profile_Bot for details);</p> <p>bit 9 (value 512): Surface retrieval is suspect or rejected. (see Qual_Surf for details);</p> <p>bit 8 (value 256): This record type not yet validated. For v4.0 all regions North of Latitude 50.0 degrees or South of Latitude - 50.0 degrees will be flagged.;</p> <p>bits 6-7: spare, set to zero;</p>

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			bit 5 (value 32): Cloud retrieval rejected or not attempted; bit 4 (value 16): Final retrieval rejected or not attempted; bit 3 (value 8): Final Cloud Clearing rejected or not attempted; bit 2 (value 4): Regression First Guess rejected or not attempted; bit 1 (value 2): Initial Cloud Clearing rejected or not attempted; bit 0 (LSB, value 1): MW retrieval rejected or not attempted
Qual_MW_Only_Temp_Strat	16-bit unsigned integer	None	Overall quality flag for MW-Only temperature fields for altitudes above 201 mbar. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_MW_Only_Temp_Tropo	16-bit unsigned integer	None	Overall quality flag for MW-Only temperature fields for altitudes at and below 201 mbar, including surface temperature. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_MW_Only_H2O	16-bit unsigned integer	None	Overall quality flag for MW-Only water (both vapor and liquid) fields. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Cloud_OLR	16-bit unsigned integer	None	Overall quality flag for cloud parameters and clear and cloudy OLR. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_H2O	16-bit unsigned integer	None	Overall quality flag for water vapor fields. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_O3	16-bit unsigned integer	None	Quality flag for ozone. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Temp_Profile_Top	16-bit unsigned integer	None	Quality flag for temperature profile at and above Press_mid_top_bndry mbar. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Temp_Profile_Mid	16-bit unsigned integer	None	Quality flag for temperature profile between Press_mid_top_bndry mbar and Press_bot_mid_bndry mbar. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Temp_Profile_Bot	16-bit unsigned integer	None	Quality flag for temperature profile below Press_bot_mid_bndry mbar, including surface air temperature. 0: Highest Quality;

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			1: Good Quality; 2: Do Not Use
Qual_Surf	16-bit unsigned integer	None	Overall quality flag for surface fields including surface temperature, emissivity, and reflectivity. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Guess_PSurf	16-bit unsigned integer	None	Quality flag for surface pressure guess input.0: Highest Quality -- from timely forecast; 1: Good Quality -- from climatology; 2: Do Not Use
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;

# A1-7. L2 Standard Atmospheric/Surface Product Interface Specification

			<p>bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 22-31: not used</p>
zengeoqa	16-bit unsigned integer	None	<p>Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value;</p> <p>bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT;</p> <p>bit 8: (Sun) bad input value;</p> <p>bit 9: (suppressed) PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night);</p> <p>bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT</p>
demgeoqa	16-bit unsigned integer	None	<p>Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: Could not allocate memory;</p> <p>bit 2: Too close to North or South pole. Excluded;</p> <p>bit 3: Layer resolution incompatibility. Excluded;</p> <p>bit 4: Any DEM Routine (elev) returned PGSDDEM_E_IMPROPER_TAG;</p> <p>bit 5: Any DEM Routine (elev) returned PGSDDEM_E_CANNOT_ACCESS_DATA;</p> <p>bit 6: Any DEM Routine (land/water)</p>

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			<p>returned PGSDM_E_IMPROPER_TAG;  bit 7: Any DEM Routine (land/water)  returned  PGSDM_E_CANNOT_ACCESS_DATA;  bit 8: Reserved for future layers;  bit 9: Reserved for future layers;  bit 10: PGS_DEM_GetRegion(elev) returned  PGSDM_M_FILLVALUE_INCLUDED;  bit 11: PGS_DEM_GetRegion(land/water)  returned  PGSDM_M_FILLVALUE_INCLUDED;  bit 12: Reserved for future layers;  bit 13: PGS_DEM_GetRegion(all) returned  PGSDM_M_MULTIPLE_RESOLUTIONS;  bit 14: PGS_CSC_GetFOV_Pixel() returned  any 'W' class return code except  PGSCSC_W_PREDICTED_UT1;  bit 15: PGS_CSC_GetFOV_Pixel() returned  any 'E' class return code</p>
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac

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latAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center latitude of AIRS spots in degrees North (-90.0 ... 90.0)
lonAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center longitude of AIRS spots in degrees East (-180.0 ... 180.0)
numHingeSurf	16-bit integer	None	Number of IR hinge points for surface emissivity and reflectivity
numCloud	32-bit integer	None	Number of cloud layers
freqEmis	32-bit floating-point	HingeSurf (= 100)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurf elements are valid)
MWSurfClass	8-bit integer	None	Surface class from MW: 0 for coastline (liquid water covers 1-50% of area); 1 for land (liquid water covers < 1% of area); 2 for ocean (liquid water covers > 50% of area); 3 for sea ice (high-emissivity); 4 for sea ice (low-emissivity); 5 for snow (higher-frequency scattering); 6 for glacier/snow (very low-frequency scattering); 7 for snow (lower-frequency scattering); -1/255 for unknown; more TBD
PSurfStd	32-bit floating-point	None	Surface pressure first guess in mbar, interpolated from forecast
nSurfStd	32-bit integer	None	Index in pressStd array of first pressure level above mean surface (1 ... 15)
Press_mid_top_bndry	32-bit floating-point	None	Pressure level in mbar, at and above which the quality of the temperature profile is given by Qual_Temp_Profile_top. Below this level use Qual_Temp_Profile_mid.
nStd_mid_top_bndry	16-bit integer	None	Index of nearest standard pressure level nearest Press_mid_top_bndry (1 ... 28)
Press_bot_mid_bndry	32-bit floating-point	None	Pressure level in mbar, at and below which the quality of the temperature profile is given by Qual_Temp_Profile_bot. Above this level use Qual_Temp_Profile_mid.
nStd_bot_mid_bndry	16-bit integer	None	Index of nearest standard pressure level nearest Press_bot_mid_bndry (1 ... 28)
TSurfStd	32-bit floating-point	None	Surface skin temperature in Kelvins
TSurfAir	32-bit	None	Surface air temperature in Kelvins

## A1-7. L2 Standard Atmospheric/Surface Product Interface Specification

	floating-point		
Press_valid_bottom	32-bit floating-point	None	Bottom pressure at which temperature, water vapor, and ozone profiles are valid (mbar)
TAirStd	32-bit floating-point	StdPressureLev (= 28)	Atmospheric Temperature at StdPressLev in Kelvins. Value at 1-based index of nSurfStd. May be an unphysical extrapolated value for a pressure level below the surface. Use TSurfAir for the surface air temperature.
TAirMWOnlyStd	32-bit floating-point	StdPressureLev (= 28)	Atmospheric Temperature retrieved using only MW information (no IR) at StdPressLev in Kelvins. Value at 1-based index of nSurfStd. May be an unphysical extrapolated value for a pressure level below the surface. Use TSurfAir for the surface air temperature.
H2OMMRStd	32-bit floating-point	StdPressureLev (= 28)	Water Vapor Mass Mixing Ratio (gm / kg dry air)
H2OMMRSat	32-bit floating-point	StdPressureLev (= 28)	Water vapor saturation mass mixing ratio (gm / kg dry air)
totH2OStd	32-bit floating-point	None	Total precipitable water vapor (kg / m**2)
totH2OMWOnlyStd	32-bit floating-point	None	Total precipitable water vapor from MW-only retrieval (no IR information used) (kg / m**2)
O3VMRStd	32-bit floating-point	StdPressureLev (= 28)	Ozone Volume Mixing Ratio (vmr)
totO3Std	32-bit floating-point	None	Total ozone burden (Dobson units)
emisIRStd	32-bit floating-point	HingeSurf (= 100)	Spectral IR Surface Emissivities (in order of increasing frequency. Only first numHingeSurf elements are valid)
rhoIRStd	32-bit floating-point	HingeSurf (= 100)	Spectral IR Bidirectional Surface Reflectance, including cloud shadow effects (in order of increasing frequency. Only first numHingeSurf elements are valid)
sfcTbMWStd	32-bit floating-point	MWHingeSurf (= 7)	Microwave surface brightness (Kelvins) (Emitted radiance only; reflected radiance not included)
EmisMWStd	32-bit floating-point	MWHingeSurf (= 7)	Spectral emissivity at the 7 MW frequencies listed for dimension MWHingeSurf (sfcTbMWStd / TSurfStd, or Undefined if IR fails)
totCldH2OStd	32-bit	None	Total cloud liquid water in kg/m**2

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	floating-point		
TCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top temperature in Kelvins (in order of increasing pressure. Only first numCloud elements are valid)
PCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top pressure in mbar
CldFrcStd	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud fraction (0.0 ... 1.0) assuming the cloud emissivity at 930 cm-1 is unity (in order of increasing pressure. Only first numCloud elements are valid)
TCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for TCldTopStd
PCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for PCldTopStd
CldFrcStdErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for CldFrcStd
PSurfStdErr	32-bit floating-point	None	Error estimate for PSurfStd
TSurfStdErr	32-bit floating-point	None	Error estimate for TSurfStd
TAirStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for TAirStd
H2OMMRStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for H2OMMRStd
totH2OStdErr	32-bit floating-point	None	Error estimate for totH2OStd
O3VMRStdErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for O3VMRStd
totO3StdErr	32-bit floating-point	None	Error estimate for totO3Std
emisIRStdErr	32-bit floating-point	HingeSurf (= 100)	Error estimate for emisIRStd
rhoIRStdErr	32-bit floating-point	HingeSurf (= 100)	Error estimate for rhoIRStd

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EmisMWStdErr	32-bit floating-point	MWHingeSurf (= 7)	Error estimate for EmisMWStd
totCldH2OStdErr	32-bit floating-point	None	Error estimate for totCldH2OStd
PTropopause	32-bit floating-point	None	Tropopause height (mbar)
GP_Height	32-bit floating-point	StdPressureLev (= 28)	Geopotential Heights at StdPressureLev (m above mean sea level)
GP_Height_MWOnly	32-bit floating-point	StdPressureLev (= 28)	Geopotential Heights from MW-Only retrieval (No IR information used) at StdPressureLev (m above mean sea level)
GP_Surface	32-bit floating-point	None	Geopotential Height of surface (m above mean sea level)
clear_flag_4um	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Clear flag based on level of agreement of predicted SST using AIRS 4 microns (2616 & 2707 cm <sup>-1</sup> ) observations with SST from a forecast model combined with a spatial homogeneity test of brightness temperature at 2616 cm <sup>-1</sup> over 3X3 AIRS footprints. 1: believed clear; 0: clear test failed or inconclusive; -1/255: clear test not attempted.
clear_flag_11um	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Clear flag based on level of agreement of predicted SST using AIRS 11 microns split window observations with SST from a forecast model combined with a spatial homogeneity test of the SST agreement described above over 3X3 AIRS footprints. 1: believed clear; 0: clear test failed or inconclusive; -1/255: clear test not attempted.
olr	32-bit floating-point	None	Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm <sup>-1</sup> (Watts/m <sup>2</sup> )
olr_err	32-bit floating-point	None	Error estimate for olr (Watts/m <sup>2</sup> )
clrolr	32-bit floating-point	None	Clear-sky Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm <sup>-1</sup> (Watts/m <sup>2</sup> )
clrolr_err	32-bit floating-point	None	Error estimate for clrolr (Watts/m <sup>2</sup> )
CldFracVis	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (=	Cloud Fraction of Visible pixels in AIRS field-of-view identified as cloudy (-9999.0 for unknown)

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		3)	
CldFracVisErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Error Estimate for CldFracVis
ClrFracVis	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Clear Fraction of Visible pixels in AIRS field-of-view identified as clear. (-9999.0 for unknown) NOTE: because some pixels cannot be identified as either clear or cloudy CldFracVis + ClrFracVis may be less than 1.0
ClrFracVisErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Error Estimate for ClrFracVis
CC_noise_eff_amp_factor	32-bit floating-point	None	Effective amplification of noise in IR window channels due to extrapolation in cloud clearing and uncertainty of clear state. (< 1.0 for noise reduction, >1.0 for noise amplification, -9999.0 for unknown)
CC1_noise_eff_amp_factor	32-bit floating-point	None	Equivalent of CC_noise_eff_amp_factor but from the first attempt at cloud clearing
all_spots_avg	8-bit integer	None	1: the cloud clearing step judged the scene to be clear enough that it averaged all spots' radiances; 0: cloud clearing was applied to the radiances; -1/255: cloud clearing not attempted
MW_ret_used	8-bit integer	None	MW-only final retrieval used
vis_clear	8-bit integer	None	at least 97.2% of each IR FOV within the AMSU FOV is clear sky
vis_cloudy	8-bit integer	None	at least 79.2% of each IR FOV within the AMSU FOV is cloudy
vis_low_cloud	8-bit integer	None	at least 79.2% of each IR FOV within the AMSU FOV is low_cloud
Initial_CC_score	32-bit floating-point	None	Indicator of how well the initial cloud-cleared radiances match radiances reconstructed from clear eigenvectors. (Unitless ratio; 0.33 is best possible, a 3X noise reduction; <0.8 for a very good match; <3.0 for a pretty good match; >10.0 indicates a major problem)
retrieval_type	8-bit integer	None	Deprecated -- use RetQAFlag. Retrieval type: 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed; 30 for only MW stage succeeded, initial + final retrieval failed;

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			40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;
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Size: 5125950 bytes (5.1 MB) per 45-scanset granule

***Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
5161229 bytes (5.2 MB) per 45-scanset granule = 1238.7 MB per day***

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## A1-8. L2 Standard Cloud-Cleared Radiance Product Interface Specification

Interface Specification Version 4.0.9.0

2005-02-01

ESDT ShortName = "AIRI2CCF"

Swath Name = "L2\_Standard\_cloud-cleared\_radiance\_product"

Level = "level2"

# Footprints = 30

# scanlines per scanset = 1

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
Channel	2378	Dimension of channel array (Channels are generally in order of increasing wavenumber, but because frequencies can vary and because all detectors from a physical array of detector elements (a "module") are always grouped together there are sometimes small reversals in frequency order where modules overlap.)
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)

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Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993
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Size: 32400 bytes (0.0 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level2")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)

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start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (3 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit	Orbit Geolocation QA: bit 0 (LSB): bad input value (last

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	unsigned integer	<p>scanline);</p> <p>bit 1: bad input value (first scanline);</p> <p>bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT;</p> <p>bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT;</p> <p>bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG;</p> <p>bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT;</p> <p>bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1;</p> <p>bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME;</p> <p>bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE;</p> <p>bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE;</p> <p>bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT;</p> <p>bit 25-31: not used</p>
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongoqa	16-bit integer	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa

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num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
CalGranSummary	8-bit unsigned integer	Bit field. Bitwise OR of CalChanSummary, over all good channels (see ExcludedChans) Zero means all good channels were well calibrated, for all scanlines. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
DCR_scan	16-bit integer	Level-1B scanline number following (first) DC-Restore. 0 for no DC-Restore. DCR_scan refers to Level-1 8/3-second scans, not Level-2 8-second scansets. DCR_scan = 1 refers to an event before the first scan of the first scanset; DCR_scan = 2 or 3 refer to events within the first scanset, DCR_scan = 4 to events between the first and second scansets.
granules_present_L1B	string of 8-bit characters	Zero-terminated character string denoting which adjacent granules were available for smoothing during Level-1B calibration processing. ("All" for both previous & next, "Prev" for previous but not next, "Next" for next but not previous, "None" for neither previous nor next)

Size: 177 bytes (0.0 MB) per granule

### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
freq	32-bit floating-point	Channel (= 2378)	Frequencies associated with each channel (in cm** <sup>-1</sup> )
nominal_freq	32-bit floating-point	Channel (= 2378)	Nominal frequencies (in cm** <sup>-1</sup> ) of each channel
CalChanSummary	8-bit unsigned integer	Channel (= 2378)	Bit field. Bitwise OR of CalFlag, by channel, over all scanlines. Noise threshold and spectral quality added. Zero means the channel was well calibrated

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			for all scanlines bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: noise out of bounds; bit 2: anomaly in spectral calibration; bit 1: Telemetry; bit 0: unused (reserved);
ExcludedChans	8-bit unsigned integer	Channel (= 2378)	An integer 0-6, indicating A/B detector weights. Used in L1B processing. 0 - A weight = B weight. Probably better that channels with state > 2; 1 - A-side only. Probably better that channels with state > 2; 2 - B-side only. Probably better that channels with state > 2; 3 - A weight = B weight. Probably better than channels with state = 6; 4 - A-side only. Probably better than channels with state = 6; 5 - B-side only. Probably better than channels with state = 6; 6 - A weight = B weight.
NeN_L1B	32-bit floating-point	Channel (= 2378)	Level-1B Noise-equivalent Radiance (radiance units) for an assumed 250K scene. Note that effective noise on cloud-cleared radiances will be modified.

Size: 33292 bytes (0.0 MB) per granule

### Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned

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			PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE; bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED; bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN; bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS; bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT; bit 13: PGS_CSC_ECtoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 14: PGS_CSC_ECtoECR() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_ECtoECR() returned PGSTD_E_NO_LEAP_SECS; bit 16: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_FMT_ERROR; bit 17: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_VALUE_ERROR; bit 18: unused (set to zero); bit 19: PGS_CSC_ECtoECR() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_ECtoECR() returned PGS_E_TOOLKIT; bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS; bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE; bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY; bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING; bit 25: PGS_CSC_ECRtoGEO() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned	None	Glint Geolocation QA flags: bit 0 (LSB): bad input value;

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	integer		<p>bit 1: glint location in Earth's shadow;  bit 2: glint calculation not converging;  bit 3: glint location sun vs. satellite zenith mismatch;  bit 4: glint location sun vs. satellite azimuth mismatch;  bit 5: bad glint location;  bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code;  bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code;  bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code;  bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code;  bit 10: PGS_CSC_ECltoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint);  bit 11: PGS_CSC_ECltoECR() returned any 'E' class return code (for Glint);  bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint);  bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint);  bit 14: PGS_CSC_ECltoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ;  bit 15: PGS_CSC_ECltoECR() returned any 'E' class return code</p>
moongeoqa	16-bit unsigned integer	None	<p>Moon Geolocation QA flags: bit 0 (LSB): bad input value;  bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS;  bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT;  bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE;  bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR;  bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE;  bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID;  bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY;  bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE;  bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME;  bit 10: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_TIME_OUT_OF_RANGE;  bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN;  bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;  bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE;  bit 14: PGS_CBP_Sat_CB_Vector() returned</p>

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			PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating- point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating- point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating- point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating- point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating- point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)
CalFlag	8-bit unsigned integer	Channel (= 2378)	Bit field, by channel, for calibration the current scanset. Zero means the channel was well calibrated, for this scanset. bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: cold scene noise
CalScanSummary	8-bit unsigned integer	None	Bit field. Bitwise OR of CalFlag over the good channel list (see ExcludedChans). Zero means all "good" channels were well calibrated for this scanset bit 7 (MSB): scene over/underflow; bit 6: anomaly in offset calculation; bit 5: anomaly in gain calculation; bit 4: pop detected; bit 3: DCR Occurred; bit 2: Moon in View; bit 1: telemetry out of limit condition; bit 0: cold_scene noise

Size: 109620 bytes (0.1 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
RetQAFlag	16-bit unsigned integer	None	Retrieval QA flags: users are advised not to use unless all bits are zero. bit 15: spare, set to zero.; bit 14 (value 16384): Ozone retrieval is

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			<p>suspect or rejected. (see Qual_O3 for details);  bit 13 (value 8192): Water vapor retrieval is suspect or rejected. (see Qual_H2O for details);  bit 12 (value 4096): Top part of temperature profile quality check failed or not attempted. (above Press_mid_top_bndry mbar, indices nStd_mid_top_bndry and nSup_mid_top_bndry; see Qual_Temp_Profile_Top for details);  bit 11 (value 2048): Middle part of temperature profile quality check failed or not attempted. (between Press_bot_mid_bndry and Press_top_mid_bndry mbar, indices nStd_bot_mid_bndry, nSup_bot_mid_bndry, nStd_bot_mid_bndry, and nSup_bot_mid_bndry; see Qual_Temp_Profile_Mid for details);  bit 10 (value 1024): Bottom part of temperature profile quality check failed or not attempted. (below Press_bot_mid_bndry mbar, indices nStd_bot_mid_bndry and nSup_bot_mid_bndry; see Qual_Temp_Profile_Bot for details);  bit 9 (value 512): Surface retrieval is suspect or rejected. (see Qual_Surf for details);  bit 8 (value 256): This record type not yet validated. For v4.0 all regions North of Latitude 50.0 degrees or South of Latitude - 50.0 degrees will be flagged.;  bits 6-7: spare, set to zero;  bit 5 (value 32): Cloud retrieval rejected or not attempted;  bit 4 (value 16): Final retrieval rejected or not attempted;  bit 3 (value 8): Final Cloud Clearing rejected or not attempted;  bit 2 (value 4): Regression First Guess rejected or not attempted;  bit 1 (value 2): Initial Cloud Clearing rejected or not attempted;  bit 0 (LSB, value 1): MW retrieval rejected or not attempted</p>
Qual_CC_Rad	16-bit unsigned integer	None	Overall quality flag for cloud cleared radiances. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
radiances	32-bit floating-point	Channel (= 2378)	Cloud-cleared radiances for each channel in milliWatts/m**2/cm**-1/steradian
radiance_err	32-bit floating-point	Channel (= 2378)	Error estimate for radiances (milliWatts/m**2/cm**-1/steradian)
CldClearParam	32-bit	AIRSTrack	Cloud clearing parameter Eta

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	floating-point	(= 3) * AIRSXTrack (= 3)	
scanang	32-bit floating-point	None	Scanning angle of AIRS instrument with respect to the spacecraft for this footprint (-180.0 ... 180.0, negative at start of scan, 0 at nadir)
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZERO_PIXEL_VECTOR; bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL; bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD; bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG; bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL; bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING; bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD; bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY; bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS; bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR; bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR; bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1; bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE; bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT; bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 22-31: not used
zengeoqa	16-bit unsigned	None	Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value;

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	integer		<p>bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT;</p> <p>bit 8: (Sun) bad input value;</p> <p>bit 9: (suppressed)</p> <p>PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night);</p> <p>bit 10: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 11: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 12: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 13: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 14: PGS_CSC_ZenithAzimuth(Sun) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 15: PGS_CSC_ZenithAzimuth(Sun) returned PGS_E_TOOLKIT</p>
demgeoqa	16-bit unsigned integer	None	<p>Digital Elevation Model (DEM) Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: Could not allocate memory;</p> <p>bit 2: Too close to North or South pole. Excluded;</p> <p>bit 3: Layer resolution incompatibility. Excluded;</p> <p>bit 4: Any DEM Routine (elev) returned PGSDM_E_IMPROPER_TAG;</p> <p>bit 5: Any DEM Routine (elev) returned PGSDM_E_CANNOT_ACCESS_DATA;</p> <p>bit 6: Any DEM Routine (land/water) returned PGSDM_E_IMPROPER_TAG;</p> <p>bit 7: Any DEM Routine (land/water) returned PGSDM_E_CANNOT_ACCESS_DATA;</p> <p>bit 8: Reserved for future layers;</p> <p>bit 9: Reserved for future layers;</p> <p>bit 10: PGS_DEM_GetRegion(elev) returned PGSDM_M_FILLVALUE_INCLUDED;</p> <p>bit 11: PGS_DEM_GetRegion(land/water)</p>

## A1-8. L2 Standard Cloud-Cleared Radiance Product Interface Specification

			<p>returned  PGSDEM_M_FILLVALUE_INCLUDED;  bit 12: Reserved for future layers;  bit 13: PGS_DEM_GetRegion(all) returned  PGSDEM_M_MULTIPLE_RESOLUTIONS;  bit 14: PGS_CSC_GetFOV_Pixel() returned  any 'W' class return code except  PGSCSC_W_PREDICTED_UT1;  bit 15: PGS_CSC_GetFOV_Pixel() returned  any 'E' class return code</p>
satzen	32-bit floating- point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating- point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating- point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating- point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating- point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating- point	None	Error estimate for topog
landFrac	32-bit floating- point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating- point	None	Error estimate for landFrac
CCN_sst1231r5	32-bit floating- point	None	Experimental cloud indicator #1 -- Final cloud clearing surface temperature from BT(1231 cm-1) assuming 0.98 emissivity. sst1231r5 should agree with surface temperature retrieval over ocean within 0.5 K.
CCN_d2392r1	32-bit floating- point	None	Experimental cloud indicator #2 -- Final cloud clearing surface air temperature difference. Over ocean d2392r1 > -2.0 is a likely cloud-free spectrum.

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CCN_dd12g5	32-bit floating-point	None	Experimental cloud indicator #3 -- Final cloud clearing daytime gradient indicator BT(2616 cm <sup>-1</sup> ) - BT(1231 cm <sup>-1</sup> ) assuming 0.99 emissivity. Over ocean abs(dd12g5) < 0.5 is a likely cloud-free spectrum.
CCN_d12	32-bit floating-point	None	Experimental cloud indicator #4 -- Final cloud clearing night gradient indicator BT(2616 cm <sup>-1</sup> ) - BT(1231 cm <sup>-1</sup> ) assuming 0.98 emissivity. At night over ocean abs(d12) < 0.25 indicates a cloud-free spectrum.
CCN_d23	32-bit floating-point	None	Experimental cloud indicator #5 -- Final cloud clearing BT(1231 cm <sup>-1</sup> ) - BT(943 cm <sup>-1</sup> ) predictor for sensing thin cirrus and silicate dust. Over ocean abs(d23) > 0.25 K flags cirrus and/or silicate dust. Use in combination with d34 to discriminate silicate dust from cirrus.
CCN_d34	32-bit floating-point	None	Experimental cloud indicator #6 -- Final cloud clearing BT(943 cm <sup>-1</sup> ) - BT(790 cm <sup>-1</sup> ) predictor for sensing thin cirrus. abs(d34) > 0.5 K indicates cirrus. Use in combination with d23.
CCN_lrt	32-bit floating-point	None	Experimental cloud indicator #7 -- Final cloud clearing Lapse rate test. lrt > 3.5 K over tropical ocean indicates cloud-free data.
CCN_g5n	32-bit floating-point	None	Experimental cloud indicator #8 -- Final cloud clearing Glint discriminator. Over ocean gn5 > 3 indicates a spectrum distorted by a sun glint
CCR_pass_clear_tests	32-bit integer	None	Go/No go flag based on cloud cleared radiances. 1: Cloud cleared radiances have the same spectral properties as clear ocean Level-1B IR radiances; 0: Cloud cleared radiances do NOT have the same spectral properties as clear ocean Level-1B IR radiances; -9999: Unknown
CC_noise_eff_amp_factor	32-bit floating-point	None	Effective amplification of noise in IR window channels due to extrapolation in cloud clearing and uncertainty of clear state. (< 1.0 for noise reduction, >1.0 for noise amplification, -9999.0 for unknown)
CCfinal_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the final cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
invalid	8-bit integer	None	Profile is not valid
all_spots_avg	8-bit integer	None	1: the cloud clearing step judged the scene to be clear enough that it averaged all spots' radiances;

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			0: cloud clearing was applied to the radiances; -1/255: cloud clearing not attempted
clear_lw_resid	8-bit integer	None	1: Low residuals of 800-900 cm <sup>-1</sup> window channels indicate high likelihood scene is clear; 0: High residuals of 800-900 cm <sup>-1</sup> window channels indicate low likelihood scene is clear; -1/255: cloud clearing not attempted
MW_ret_used	8-bit integer	None	MW-only final retrieval used
bad_clouds	8-bit integer	None	invalid cloud parameters
vis_clear	8-bit integer	None	at least 97.2% of each IR FOV within the AMSU FOV is clear sky
vis_cloudy	8-bit integer	None	at least 79.2% of each IR FOV within the AMSU FOV is cloudy
vis_low_cloud	8-bit integer	None	at least 79.2% of each IR FOV within the AMSU FOV is low_cloud
retrieval_type	8-bit integer	None	Deprecated -- use RetQAFlag. Retrieval type: 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed; 30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;

Size: 25870050 bytes (25.9 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
26045539 bytes (26.0 MB) per 45-scanset granule = 6250.9 MB per day**

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## A1-9. L2 Support Atmospheric/Surface Product Interface Specification

Interface Specification Version 4.0.9.0

2005-02-01

ESDT ShortName = "AIRX2SUP"

Swath Name = "L2\_Support\_atmospheric&surface\_product"

Level = "level2"

# Footprints = 30

# scanlines per scanset = 1

### Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath Data Fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
StdPressureLev	28	Number of standard pressure altitude levels (from bottom of the atmosphere up); nSurfStd is the 1-based index of the first valid level for a given profile. Any levels before this are below the surface. Since the actual surface will not be exactly at this level, it will be necessary to extrapolate or interpolate to get precise surface values. See entries for specific fields for more details.
StdPressureLay	28	Number of standard pressure altitude layers (Always equal to StdPressureLev: last layer goes to the top of the atmosphere); nSurfStd is the 1-based index of the first valid layer for a given profile. Any layers before this are below the surface. Since the actual surface will not be exactly at the bottom of this layer, it will be necessary to extrapolate or interpolate to get total amounts for surface layers. See entries for specific fields for more details.
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is

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		the same as GeoTrack -- parallel to the satellite's path, increasing with time
Cloud	2	Cloud layer dimension in order of increasing pressure. Only first numCloud elements are valid
ChanAMSUA	15	Dimension of AMSU-A Channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
ChanHSB	5	Dimension of HSB Channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz (f0 = 183.31 GHz))
MWHingeSurf	7	Number of standard frequency hinge points in Microwave surface emissivity and surface brightness. Frequencies are 23.8, 31.4, 50.3, 52.8, 89.0, 150.0, 183.31 GHz respectively. Values are also found in field MWHingeSurfFreqGHz.
XtraPressureLev	100	Number of pressure altitude layers in high vertical resolution support products (from top of the atmosphere down); nSurfSup is the 1-based index of the last valid level for a given profile. Any levels beyond this are below the surface. Since the actual surface will not be exactly at this level, it will be necessary to extrapolate or interpolate to get precise surface values. See entries for specific fields for more details.
XtraPressureLay	100	Number of pressure altitude layers in high vertical resolution support products (Always equal to XtraressureLev: first layer goes from the top of the atmosphere to level 1); nSurfSup is the 1-based index of the last valid layer for a given profile. Any layers beyond this are below the surface. Since the actual surface will not be exactly at the bottom of this layer, it will be necessary to extrapolate or interpolate to get total amounts for surface layers. See entries for specific fields for more details.
HingeCloud	7	Frequency hinge points in cloud emissivity in order of increasing frequency. Only first numHingeCloud elements are valid
HingeSurfInit	50	Maximum number of frequency hinge points in IR surface emissivity from initial regression
VisXTrack	8	The number of Vis cross-track spots per AIRS. Direction is the same as GeoXTrack & AIRSXTrack -- starting at the left and increasing towards the right as you look along the satellite's path

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VisTrack	9	The number of Vis along-track spots per AIRS. Direction is the same as GeoTrack & AIRSTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
VChn	4	The number of Visible channels
ScoresBand	10	The number of IR frequency bands for which Initial_CC_subscores are calculated. Band limits are (in cm <sup>-1</sup> ): 645., 704., 800., 1000., 1200., 2200., 2304., 2382., 2390., 2400., 2600.
CCTest	10	The number of cloud-clearing tests
VisGeoSpots	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.
MODISEmisBand	6	MODIS bands for IR emissivity first guess: 833.33, 909.09, 1169.6, 2469.1, 2531.6, and 2666.7 cm <sup>-1</sup> .

### Geolocation Fields

These fields appear for every footprint (GeoTrack \* GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

Size: 32400 bytes (0.0 MB) per 45-scanset granule

### Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface

Name	Type	Explanation
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("level2")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is more than 6 degrees below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints

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NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)
granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit	Geodetic Latitude of spacecraft at start of granule in degrees

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	floating-point	North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	Orbit Geolocation QA: bit 0 (LSB): bad input value (last scanline); bit 1: bad input value (first scanline); bit 2: PGS_EPH_GetEphMet() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 3: PGS_EPH_GetEphMet() returned PGSEPH_E_BAD_ARRAY_SIZE; bit 4: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_FMT_ERROR; bit 5: PGS_EPH_GetEphMet() returned PGSTD_E_TIME_VALUE_ERROR; bit 6: PGS_EPH_GetEphMet() returned PGSTD_E_SC_TAG_UNKNOWN; bit 7: PGS_EPH_GetEphMet() returned PGS_E_TOOLKIT; bit 8: PGS_TD_UTCtoTAI() returned PGSTD_E_NO_LEAP_SECS; bit 9: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_FMT_ERROR; bit 10: PGS_TD_UTCtoTAI() returned PGSTD_E_TIME_VALUE_ERROR; bit 11: PGS_TD_UTCtoTAI() returned PGS_E_TOOLKIT; bit 12: PGS_CSC_DayNight() returned PGSTD_E_NO_LEAP_SECS; bit 13: PGS_CSC_DayNight() returned PGSCSC_E_INVALID_LIMITTAG; bit 14: PGS_CSC_DayNight() returned PGSCSC_E_BAD_ARRAY_SIZE; bit 15: PGS_CSC_DayNight() returned PGSCSC_W_ERROR_IN_DAYNIGHT;

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		bit 16: PGS_CSC_DayNight() returned PGSCSC_W_BAD_TRANSFORM_VALUE; bit 17: PGS_CSC_DayNight() returned PGSCSC_W_BELOW_HORIZON; bit 18: PGS_CSC_DayNight() returned PGSCSC_W_PREDICTED_UT1; bit 19: PGS_CSC_DayNight() returned PGSTD_E_NO_UT1_VALUE; bit 20: PGS_CSC_DayNight() returned PGSTD_E_BAD_INITIAL_TIME; bit 21: PGS_CSC_DayNight() returned PGSCBP_E_TIME_OUT_OF_RANGE; bit 22: PGS_CSC_DayNight() returned PGSCBP_E_UNABLE_TO_OPEN_FILE; bit 22: PGS_CSC_DayNight() returned PGSMEM_E_NO_MEMORY; bit 24: PGS_CSC_DayNight() returned PGS_E_TOOLKIT; bit 25-31: not used
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit integer	Number of scans with problems in glintgeoqa
num_moongoqa	16-bit integer	Number of scans with problems in moongoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
numHingeSurfInit	32-bit integer	Number of IR hinge points for surface emissivity and reflectivity from initial regression
NumVisInvalid	32-bit integer	Number of profiles in which L2 Vis processing encountered a problem
NumMWStratIrRetOnly	32-bit integer	Number of profiles in which the final product comes only from MW and stratospheric IR information (retrieval_types 20, 30, 40)
NumNoHSB	32-bit integer	Number of retrieval profiles for which no HSB input data is used
NumNoAMSUA	32-bit integer	Number of retrieval profiles for which no AMSU-A input data is used

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NumNoAIRS	32-bit integer	Number of retrieval profiles for which no AIRS-IR input data is used
NumNoVis	32-bit integer	Number of retrieval profiles for which no AIRS-V/NIR input data is used
DCRCount	32-bit integer	Number of times a Direct Current Restore was executed for any module
PopCount	32-bit integer	Number of popcorn events within granule, i.e. number of times that an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in a Microwave space view (approx)
VegMapFileName	string of 8-bit characters	Name of input file used as Vegetation Map

Size: 214 bytes (0.0 MB) per granule

### Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface

Name	Type	Extra Dimensions	Explanation
pressSupp	32-bit floating-point	XtraPressureLev (= 100)	Support pressures (lower boundary) in mbar.
MWHingeSurfFreqGHz	32-bit floating-point	MWHingeSurf (= 7)	Frequencies in GHz for MW surface parameters (SfcTbMWStd, EmisMWStd,...)
freqEmisInit	32-bit floating-point	HingeSurfInit (= 50)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
rhoVisErr	8-bit integer	VisTrack (= 9) * VChn (= 4)	Error estimate for rhoVis

Size: 664 bytes (0.0 MB) per granule

### Along-Track Data Fields

These fields appear once per scanline (GeoTrack times)

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)

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satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	<p>Satellite Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT;</p> <p>bit 3: PGS_EPH_EphemAttit() returned PGSEPH_W_BAD_EPHEM_VALUE;</p> <p>bit 4: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;</p> <p>bit 5: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 6: PGS_EPH_EphemAttit() returned PGSEPH_E_NO_DATA_REQUESTED;</p> <p>bit 7: PGS_EPH_EphemAttit() returned PGSTD_E_SC_TAG_UNKNOWN;</p> <p>bit 8: PGS_EPH_EphemAttit() returned PGSEPH_E_BAD_ARRAY_SIZE;</p> <p>bit 9: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 10: PGS_EPH_EphemAttit() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 11: PGS_EPH_EphemAttit() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 12: PGS_EPH_EphemAttit() returned PGS_E_TOOLKIT;</p> <p>bit 13: PGS_CSC_ECtoECR() returned PGSCSC_W_BAD_TRANSFORM_VALUE;</p> <p>bit 14: PGS_CSC_ECtoECR() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 15: PGS_CSC_ECtoECR() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 16: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 17: PGS_CSC_ECtoECR() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 18: unused (set to zero);</p> <p>bit 19: PGS_CSC_ECtoECR() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 20: PGS_CSC_ECtoECR() returned PGS_E_TOOLKIT;</p> <p>bit 21: PGS_CSC_ECRtoGEO() returned PGSCSC_W_TOO_MANY_ITERS;</p> <p>bit 22: PGS_CSC_ECRtoGEO() returned PGSCSC_W_INVALID_ALTITUDE;</p> <p>bit 23: PGS_CSC_ECRtoGEO() returned PGSCSC_W_SPHERE_BODY;</p> <p>bit 24: PGS_CSC_ECRtoGEO() returned PGSCSC_W_LARGE_FLATTENING;</p> <p>bit 25: PGS_CSC_ECRtoGEO() returned</p>

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			PGSCSC_W_DEFAULT_EARTH_MODEL; bit 26: PGS_CSC_ECRtoGEO() returned PGSCSC_E_BAD_EARTH_MODEL; bit 27: PGS_CSC_ECRtoGEO() returned PGS_E_TOOLKIT; bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	<p>Glint Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: glint location in Earth's shadow;</p> <p>bit 2: glint calculation not converging;</p> <p>bit 3: glint location sun vs. satellite zenith mismatch;</p> <p>bit 4: glint location sun vs. satellite azimuth mismatch;</p> <p>bit 5: bad glint location;</p> <p>bit 6: PGS_CSC_ZenithAzimuth() returned any 'W' class return code;</p> <p>bit 7: PGS_CSC_ZenithAzimuth() returned any 'E' class return code;</p> <p>bit 8: PGS_CBP_Earth_CB_Vector() returned returned any 'W' class return code;</p> <p>bit 9: PGS_CBP_Earth_CB_Vector() returned returned any 'E' class return code;</p> <p>bit 10: PGS_CSC_ECItoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint);</p> <p>bit 11: PGS_CSC_ECItoECR() returned any 'E' class return code (for Glint);</p> <p>bit 12: PGS_CSC_ECRtoGEO() returned any 'W' class return code (for Glint);</p> <p>bit 13: PGS_CSC_ECRtoGEO() returned any 'E' class return code (for Glint);</p> <p>bit 14: PGS_CSC_ECItoECR() returned any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ;</p> <p>bit 15: PGS_CSC_ECItoECR() returned any 'E' class return code</p>
moongeoqa	16-bit unsigned integer	None	<p>Moon Geolocation QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT;</p> <p>bit 3: PGS_CBP_Sat_CB_Vector() returned PGSCSC_W_BELOW_SURFACE;</p> <p>bit 4: PGS_CBP_Sat_CB_Vector() returned PGSCBP_W_BAD_CB_VECTOR;</p> <p>bit 5: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_BAD_ARRAY_SIZE;</p> <p>bit 6: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_INVALID_CB_ID;</p> <p>bit 7: PGS_CBP_Sat_CB_Vector() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 8: PGS_CBP_Sat_CB_Vector() returned PGSCBP_E_UNABLE_TO_OPEN_FILE;</p> <p>bit 9: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_BAD_INITIAL_TIME;</p> <p>bit 10: PGS_CBP_Sat_CB_Vector() returned</p>

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			PGSCBP_E_TIME_OUT_OF_RANGE; bit 11: PGS_CBP_Sat_CB_Vector() returned PGSTD_E_SC_TAG_UNKNOWN; bit 12: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_BAD_EPHEM_FILE_HDR; bit 13: PGS_CBP_Sat_CB_Vector() returned PGSEPH_E_NO_SC_EPHEM_FILE; bit 14: PGS_CBP_Sat_CB_Vector() returned PGS_E_TOOLKIT; bit 15: not used
nadirTAI	64-bit floating- point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating- point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating- point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'N' for North-Polar, 'S' for South-Polar
glintlat	32-bit floating- point	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)
glintlon	32-bit floating- point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)

Size: 2565 bytes (0.0 MB) per 45-scanset granule

### Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack \* GeoXTrack times)

Name	Type	Extra Dimensions	Explanation
RetQAFlag	16-bit unsigned integer	None	Retrieval QA flags: users are advised not to use unless all bits are zero. bit 15: spare, set to zero.; bit 14 (value 16384): Ozone retrieval is suspect or rejected. (see Qual_O3 for details); bit 13 (value 8192): Water vapor retrieval is suspect or rejected. (see Qual_H2O for details); bit 12 (value 4096): Top part of temperature profile quality check failed or not attempted. (above Press_mid_top_bndry mbar, indices nStd_mid_top_bndry and nSup_mid_top_bndry; see Qual_Temp_Profile_Top for details); bit 11 (value 2048): Middle part of temperature profile quality check failed or not attempted. (between Press_bot_mid_bndry and

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			<p>Press_top_mid_bndry mbar, indices nStd_bot_mid_bndry, nSup_bot_mid_bndry, nStd_bot_mid_bndry, and nSup_bot_mid_bndry; see Qual_Temp_Profile_Mid for details);</p> <p>bit 10 (value 1024): Bottom part of temperature profile quality check failed or not attempted. (below Press_bot_mid_bndry mbar, indices nStd_bot_mid_bndry and nSup_bot_mid_bndry; see Qual_Temp_Profile_Bot for details);</p> <p>bit 9 (value 512): Surface retrieval is suspect or rejected. (see Qual_Surf for details);</p> <p>bit 8 (value 256): This record type not yet validated. For v4.0 all regions North of Latitude 50.0 degrees or South of Latitude - 50.0 degrees will be flagged.;</p> <p>bits 6-7: spare, set to zero;</p> <p>bit 5 (value 32): Cloud retrieval rejected or not attempted;</p> <p>bit 4 (value 16): Final retrieval rejected or not attempted;</p> <p>bit 3 (value 8): Final Cloud Clearing rejected or not attempted;</p> <p>bit 2 (value 4): Regression First Guess rejected or not attempted;</p> <p>bit 1 (value 2): Initial Cloud Clearing rejected or not attempted;</p> <p>bit 0 (LSB, value 1): MW retrieval rejected or not attempted</p>
Qual_MW_Only_Temp_Strat	16-bit unsigned integer	None	<p>Overall quality flag for MW-Only temperature fields for altitudes above 201 mbar. 0: Highest Quality;</p> <p>1: Good Quality;</p> <p>2: Do Not Use</p>
Qual_MW_Only_Temp_Tropo	16-bit unsigned integer	None	<p>Overall quality flag for MW-Only temperature fields for altitudes at and below 201 mbar, including surface temperature. 0: Highest Quality;</p> <p>1: Good Quality;</p> <p>2: Do Not Use</p>
Qual_MW_Only_H2O	16-bit unsigned integer	None	<p>Overall quality flag for MW-Only water (both vapor and liquid) fields. 0: Highest Quality;</p> <p>1: Good Quality;</p> <p>2: Do Not Use</p>
Qual_Cloud_OLR	16-bit unsigned integer	None	<p>Overall quality flag for cloud parameters and clear and cloudy OLR. 0: Highest Quality;</p> <p>1: Good Quality;</p> <p>2: Do Not Use</p>
Qual_H2O	16-bit unsigned integer	None	<p>Overall quality flag for water vapor fields. 0: Highest Quality;</p> <p>1: Good Quality;</p> <p>2: Do Not Use</p>

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Qual_O3	16-bit unsigned integer	None	Quality flag for ozone. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Temp_Profile_Top	16-bit unsigned integer	None	Quality flag for temperature profile at and above Press_mid_top_bndry mbar. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Temp_Profile_Mid	16-bit unsigned integer	None	Quality flag for temperature profile between Press_mid_top_bndry mbar and Press_bot_mid_bndry mbar. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Temp_Profile_Bot	16-bit unsigned integer	None	Quality flag for temperature profile below Press_bot_mid_bndry mbar, including surface air temperature. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Surf	16-bit unsigned integer	None	Overall quality flag for surface fields including surface temperature, emissivity, and reflectivity. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Guess_PSurf	16-bit unsigned integer	None	Quality flag for surface pressure guess input. 0: Highest Quality -- from timely forecast; 1: Good Quality -- from climatology; 2: Do Not Use
Qual_CO	16-bit unsigned integer	None	Quality flag for carbon monoxide. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_CO2	16-bit unsigned integer	None	Quality flag for carbon dioxide. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_CH4	16-bit unsigned integer	None	Quality flag for methane. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: bit 0 (LSB): bad input value; bit 1: PGS_TD_TAtoUTC() returned PGSTD_E_NO_LEAP_SECS; bit 2: PGS_TD_TAtoUTC() returned PGS_E_TOOLKIT; bit 3: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_MISS_EARTH; bit 4: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_SC_TAG_UNKNOWN; bit 5: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_ZÉRO_PIXEL_VECTOR;

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			<p>bit 6: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_EPH_FOR_PIXEL;</p> <p>bit 7: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_INSTRUMENT_OFF_BOARD;</p> <p>bit 8: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_BAD_ACCURACY_FLAG;</p> <p>bit 9: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_BAD_ARRAY_SIZE;</p> <p>bit 10: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DEFAULT_EARTH_MODEL;</p> <p>bit 11: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_DATA_FILE_MISSING;</p> <p>bit 12: PGS_CSC_GetFOV_Pixel() returned PGSCSC_E_NEG_OR_ZERO_RAD;</p> <p>bit 13: PGS_CSC_GetFOV_Pixel() returned PGSMEM_E_NO_MEMORY;</p> <p>bit 14: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_LEAP_SECS;</p> <p>bit 15: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_FMT_ERROR;</p> <p>bit 16: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_TIME_VALUE_ERROR;</p> <p>bit 17: PGS_CSC_GetFOV_Pixel() returned PGSCSC_W_PREDICTED_UT1;</p> <p>bit 18: PGS_CSC_GetFOV_Pixel() returned PGSTD_E_NO_UT1_VALUE;</p> <p>bit 19: PGS_CSC_GetFOV_Pixel() returned PGS_E_TOOLKIT;</p> <p>bit 20: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_BAD_EPHEM_FILE_HDR;</p> <p>bit 21: PGS_CSC_GetFOV_Pixel() returned PGSEPH_E_NO_SC_EPHEM_FILE;</p> <p>bit 22-31: not used</p>
zengeoqa	16-bit unsigned integer	None	<p>Satellite zenith Geolocation QA flags: bit 0 (LSB): (Spacecraft) bad input value;</p> <p>bit 1: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_BELOW_HORIZON;</p> <p>bit 2: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 3: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_W_NO_REFRACTION;</p> <p>bit 4: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_INVALID_VECTAG;</p> <p>bit 5: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 6: PGS_CSC_ZenithAzimuth(S/C) returned PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 7: PGS_CSC_ZenithAzimuth(S/C) returned PGS_E_TOOLKIT;</p> <p>bit 8: (Sun) bad input value;</p> <p>bit 9: (suppressed)</p> <p>PGS_CSC_ZenithAzimuth(Sun) returned</p>

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			<p>PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night);</p> <p>bit 10: PGS_CSC_ZenithAzimuth(Sun) returned</p> <p>PGSCSC_W_UNDEFINED_AZIMUTH;</p> <p>bit 11: PGS_CSC_ZenithAzimuth(Sun) returned</p> <p>PGSCSC_W_NO_REFRACTION;</p> <p>bit 12: PGS_CSC_ZenithAzimuth(Sun) returned</p> <p>PGSCSC_E_INVALID_VECTAG;</p> <p>bit 13: PGS_CSC_ZenithAzimuth(Sun) returned</p> <p>PGSCSC_E_LOOK_PT_ALTIT_RANGE;</p> <p>bit 14: PGS_CSC_ZenithAzimuth(Sun) returned</p> <p>PGSCSC_E_ZERO_INPUT_VECTOR;</p> <p>bit 15: PGS_CSC_ZenithAzimuth(Sun) returned</p> <p>PGS_E_TOOLKIT</p>
demgeoqa	16-bit unsigned integer	None	<p>Digital Elevation Model (DEM) Geolocation</p> <p>QA flags: bit 0 (LSB): bad input value;</p> <p>bit 1: Could not allocate memory;</p> <p>bit 2: Too close to North or South pole. Excluded;</p> <p>bit 3: Layer resolution incompatibility. Excluded;</p> <p>bit 4: Any DEM Routine (elev) returned</p> <p>PGSDEM_E_IMPROPER_TAG;</p> <p>bit 5: Any DEM Routine (elev) returned</p> <p>PGSDEM_E_CANNOT_ACCESS_DATA;</p> <p>bit 6: Any DEM Routine (land/water) returned</p> <p>PGSDEM_E_IMPROPER_TAG;</p> <p>bit 7: Any DEM Routine (land/water) returned</p> <p>PGSDEM_E_CANNOT_ACCESS_DATA;</p> <p>bit 8: Reserved for future layers;</p> <p>bit 9: Reserved for future layers;</p> <p>bit 10: PGS_DEM_GetRegion(elev) returned</p> <p>PGSDEM_M_FILLVALUE_INCLUDED;</p> <p>bit 11: PGS_DEM_GetRegion(land/water) returned</p> <p>PGSDEM_M_FILLVALUE_INCLUDED;</p> <p>bit 12: Reserved for future layers;</p> <p>bit 13: PGS_DEM_GetRegion(all) returned</p> <p>PGSDEM_M_MULTIPLE_RESOLUTIONS;</p> <p>bit 14: PGS_CSC_GetFOV_Pixel() returned any 'W' class return code except</p> <p>PGSCSC_W_PREDICTED_UT1;</p> <p>bit 15: PGS_CSC_GetFOV_Pixel() returned any 'E' class return code</p>
satzen	32-bit floating-point	None	<p>Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)</p>

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satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-point	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
satzen_amsu	32-bit floating-point	None	Satellite zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.) (AMSU-A FOV center)
satazi_amsu	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO (AMSU-A FOV center)
satzen_hsb	32-bit floating-point	None	Satellite zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.) (HSB center FOV)
satazi_hsb	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO (HSB center FOV)
MoonInViewIR	16-bit integer	None	Flag if moon was in the spaceview for IR calibration. IR calibration will handle this case, but there may be a small degradation in radiance quality. (1: moon in spaceview, 0: moon not in spaceview, -9999: unknown)

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latAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center latitude of AIRS spots in degrees North (-90.0 ... 90.0)
lonAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center longitude of AIRS spots in degrees East (-180.0 ... 180.0)
PrecipAA4_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 4 (-1/255 for unknown)
PrecipAA5_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 5 (-1/255 for unknown)
PrecipAA6_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 6 (-1/255 for unknown)
PrecipAA7_50km	8-bit unsigned integer	None	Relative interference (0-2, 3=indeterminate) of precipitation on AMSU-A channel 7 (-1/255 for unknown)
PrecipAA8_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 8 (-1/255 for unknown)
PrecipAA9_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 9 (-1/255 for unknown)
PrecipAA4_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 4 for HSB 15-km spots (-1/255 for unknown)
PrecipAA5_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 5 for HSB 15-km spots (-1/255 for unknown)
PrecipAA6_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 6 for HSB 15-km spots (-1/255 for unknown)
PrecipAA7_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2, 3=indeterminate) of precipitation on AMSU-A channel 7 for HSB 15-km spots (-1/255 for unknown)
PrecipAA8_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 8 for HSB 15-km spots (-1/255 for unknown)
PrecipAA9_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 9 for HSB 15-km spots (-1/255 for unknown)
AMSU_A_4_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 4 for precipitation effects (Kelvins)
AMSU_A_5_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 5 for precipitation effects (Kelvins)
AMSU_A_6_Precip_Corr_50km	32-bit	None	Correction to AMSU-A channel 6 for

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	floating-point		precipitation effects (Kelvins)
AMSU_A_7_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 7 for precipitation effects (Kelvins)
AMSU_A_8_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 8 for precipitation effects (Kelvins)
AMSU_A_9_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 9 for precipitation effects (Kelvins)
AMSU_A_4_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 4 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_5_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 5 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_6_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 6 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_7_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 7 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_8_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 8 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_9_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 9 for precipitation effects for HSB 15-km spots (Kelvins)
rain_rate_50km	32-bit floating-point	None	Rain rate (mm/hr)
rain_rate_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Rain rate for HSB 15-km spots (mm/hr)
MWSurfClass	8-bit integer	None	Surface class from MW: 0 for coastline (liquid water covers 1-50% of area); 1 for land (liquid water covers < 1% of area); 2 for ocean (liquid water covers > 50% of area); 3 for sea ice (high-emissivity); 4 for sea ice (low-emissivity); 5 for snow (higher-frequency scattering); 6 for glacier/snow (very low-frequency scattering); 7 for snow (lower-frequency scattering); -1/255 for unknown; more TBD
PSurfStd	32-bit floating-	None	Surface pressure first guess in mbar, interpolated from forecast

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	point		
nSurfSup	32-bit integer	None	Index of first pressure level above mean surface (90 ... 100)
Press_valid_bottom	32-bit floating-point	None	Bottom pressure at which temperature, water vapor, and ozone profiles are valid (mbar)
Press_mid_top_bndry	32-bit floating-point	None	Pressure level in mbar, at and above which the quality of the temperature profile is given by Qual_Temp_Profile_top. Below this level use Qual_Temp_Profile_mid.
Press_bot_mid_bndry	32-bit floating-point	None	Pressure level in mbar, at and below which the quality of the temperature profile is given by Qual_Temp_Profile_bot. Above this level use Qual_Temp_Profile_mid.
nSup_mid_top_bndry	16-bit integer	None	Index of nearest support pressure level nearest Press_mid_top_bndry (1 ... 100)
nSup_bot_mid_bndry	16-bit integer	None	Index of nearest support pressure level nearest Press_bot_mid_bndry (1 ... 100)
nStd_mid_top_bndry	16-bit integer	None	Index of nearest standard pressure level nearest Press_mid_top_bndry (1 ... 28)
nStd_bot_mid_bndry	16-bit integer	None	Index of nearest standard pressure level nearest Press_bot_mid_bndry (1 ... 28)
N_valid_bottom	32-bit integer	None	Index of Press_valid_bottom (1 ... 100)
TSurfStd	32-bit floating-point	None	Surface skin temperature in Kelvins
TSurfAir	32-bit floating-point	None	Surface air temperature in Kelvins
TAirSup	32-bit floating-point	XtraPressureLev (= 100)	Atmospheric Temperature at XtraPressLev in Kelvins. Value at 1-based index of nSurfSup may be an unphysical extrapolated value for a pressure level below the surface. Use TSurfAir for the surface air temperature.
H2OCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor (molecules / cm**2)
lwCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer molecular column density (molecules / cm**2) of cloud liquid water
lwCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for lwCDSup
clWSup	32-bit integer	XtraPressureLay (= 100)	Cloud Ice/Water flag (liquid = 0 / Ice = 1)
O3CDSup	32-bit floating-	XtraPressureLay (= 100)	Layer column ozone in molecules per cm**2

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	point		
O3CDInit	32-bit floating-point	XtraPressureLay (= 100)	preliminary Layer column ozone in molecules per cm**2 from initial regression step
COCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column carbon monoxide in molecules per cm**2 (climatology when bad_co is not 0)
CO_PPBV	32-bit floating-point	None	CO volume mixing ratio, in PPB, between 300 and 600 mbar. (set to -9999 when bad_co is 2)
CO_PPBV_Err	32-bit floating-point	None	Error estimate for CO_PPBV
CO2ppmv	32-bit floating-point	None	Column averaged dry carbon dioxide volumetric mixing ratio (ppmv)
CH4CDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column methane (in molecules per cm**2)
COCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for COCDSup
CO2ppmvErr	32-bit floating-point	None	Error estimate for co2qppmv
CH4CDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for CH4CDSup
numHingeCloud	16-bit integer	None	Number of hinge points for cloud emissivity and reflectivity
emisIRInit	32-bit floating-point	HingeSurfInit (= 50)	IR Surface Emissivities from initial regression (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
rhoIRInit	32-bit floating-point	HingeSurfInit (= 50)	IR Surface Reflectivities from initial regression (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
olr	32-bit floating-point	None	Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (Watts/m**2)
clrolr	32-bit floating-point	None	Clear-sky Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (Watts/m**2)
TCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top temperature in Kelvins (in order of increasing pressure. Only first numCloud elements are valid)
PCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top pressure in mbar

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	point		
CldFrcStd	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud fraction (0.0 ... 1.0) assuming the cloud emissivity at 930 cm-1 is unity (in order of increasing pressure. Only first numCloud elements are valid)
TCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for TCldTopStd
PCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for PCldTopStd
CldFrcStdErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for CldFrcStd
cldFreq	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Frequencies for cloud emissivity and reflectivity (in order of increasing pressure. Only first numCloud elements are valid) (in order of increasing frequency. Only first numHingeCloud elements are valid)
CldEmis	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Ratio of cloud IR emissivity to that at 930 cm-1 (in order of increasing frequency. Only first numHingeCloud elements are valid)
CldRho	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Future Cloud IR reflectivity -- DO NOT USE
CldEmisErr	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Error estimate for CldEmis
CldRhoErr	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Error estimate for CldRho
CldMapVis	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * VisTrack (= 9) * VisXTrack (= 8)	Map of clear/cloud pixel locations. (-1 = not known; 0 = clear; 1 = cloudy)
VarIndxAllVis	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Variability index of all visible pixels in AIRS field-of-view (-1/255 for unknown)
VarIndxCirVis	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Variability index of those visible pixels in AIRS field-of-view identified as clear (-1/255 for unknown)
rhoVis	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * VisTrack (= 9) * VisXTrack (= 8) * VChn (= 4)	Visible reflectivity integer percent (0 ... 100) (-1/255 for unknown)
cornerlats	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * VisGeoSpots	Geodetic Latitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees North (-90.0 ... 90.0)

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		(= 4) * VChn (= 4)	
cornerlons	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * VisGeoSpots (= 4) * VChn (= 4)	Geodetic Longitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees East (-180.0 ... 180.0)
fov_clear_flag	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Preliminary clear flag based on MW/IR differences
fov_rad_resid	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Preliminary residual between IR radiance and IR radiance predicted from MW
fov_psw_fr_lw_resid	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Residual between shortwave radiance & shortwave radiance predicted from longwave
fov_psst_resid	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Residual between Surface Temperatures and those predicted from window channel observations
fov_swlw_resid	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	residual between shortwave and longwave observations
fov_ocean_cc_test	32-bit floating-point	CCTest (= 10) * AIRSTrack (= 3) * AIRSXTrack (= 3)	clear tests for Ocean, test 1 to 10: 1: Brightness temperature of 965.323 cm <sup>-1</sup> ; 2: Sea Surface Temperature (SST) - brightness temperature of 965.323 cm <sup>-1</sup> ; 3: Brightness temperature of 2616.095 cm <sup>-1</sup> - predicted from 8 micron window observations; 4: Brightness temperature of 2616.095 cm <sup>-1</sup> - predicted from 11 micron window observations; 5: SST - predicted SST from window channels; 6: Store the value of SST; 7 - 10: TBD
prelim_clear_flag	8-bit integer	None	Preliminary clear flag based on IR spacial inhomogeneity
prelim_rad_dev	32-bit floating-point	None	Preliminary deviations between fov_rad_resids within a 3x3 FOV retrieval array
tsurf_forecast	32-bit floating-point	None	Predicted surface temperature from forecast (K)
tsurf_diff_4um	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Difference between SST predicted from AIRS 4 microns (2616 & 2707 cm <sup>-1</sup> ) observations and SST from a forecast model (K)
tsurf_diff_11um	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Difference between SST predicted from AIRS 11 microns split window observations and SST from a forecast model, (K)

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spatial_coh_4um	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	This is the standard deviation of brightness temperature at 2616 cm <sup>-1</sup> over 3X3 AIRS footprints as a measure of spatial homogeneity.
spatial_coh_11um	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	This is the standard deviation of Difference between SST predicted from AIRS 11 microns split window observations and SST from a forecast model, (K)
cldHgtMapVis	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3) * VisTrack (= 9) * VisXTrack (= 8)	Map of low-cloud pixel locations. (-1=unknown, 0=not low-cloud, 1=low-cloud.)
cldHgtCntVis	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Count of number of distinct cloud heights in visible data found in an AIRS field-of-view (-1/255 for unknown)
cldHgtCntVisErr	8-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Error estimate for cldHgtCntVis
TAirMWOnly	32-bit floating-point	XtraPressureLev (= 100)	Air temperature in Kelvins from microwave-only retrieval
H2OCDMWOnly	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor from microwave-only retrieval (molecules / cm**2)
TAirMWOnlyErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for TAirMWOnly (Note that error estimate only made at StdPressureLev points even though TAirMWOnly is estimated at XtraPressureLev points)
H2OCDMWOnlyErr	32-bit floating-point	StdPressureLay (= 28)	Error estimate for H2OCDMWOnly (Note that error estimate only made at StdPressureLay points even though H2OCDMWOnly is estimated at XtraPressureLay points)
TSurf1Ret	32-bit floating-point	None	Surface temperature after first retrieval in Kelvins
TSurfAir1Ret	32-bit floating-point	None	Surface air temperature after first retrieval in Kelvins
TAir1Ret	32-bit floating-point	XtraPressureLev (= 100)	Air temperature after first retrieval in Kelvins
H2OCD1Ret	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor after first retrieval (molecules / cm**2)
MW_psurf_range	8-bit integer	None	Surface pressure check for MW-only retrieval product: bit 7: unused, set to zero; bit 6 (value 64): Invalid input; bit 5 (value 32): high input value error;

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			bit 4 (value 16): low input value error; bit 3 (value 8): high input value warning; bit 2 (value 4): low input value warning; bit 1 (value 2): input value high, but not enough for warning; bit 0 (LSB, value 1): input value low, but not enough for warning
MW_tsurf_range	8-bit integer	None	Retrieved surface temperature check for MW-only retrieval product: bit 7: unused, set to zero; bit 6 (value 64): Invalid input; bit 5 (value 32): high input value error; bit 4 (value 16): low input value error; bit 3 (value 8): high input value warning; bit 2 (value 4): low input value warning; bit 1 (value 2): input value high, but not enough for warning; bit 0 (LSB, value 1): input value low, but not enough for warning
MW_tair_range	Profile range check (see below)	None	retrieved air temperature profile check for MW-only retrieval product
reg_psurf_range	8-bit integer	None	Surface pressure check for regression retrieval product: bit 7: unused, set to zero; bit 6 (value 64): Invalid input; bit 5 (value 32): high input value error; bit 4 (value 16): low input value error; bit 3 (value 8): high input value warning; bit 2 (value 4): low input value warning; bit 1 (value 2): input value high, but not enough for warning; bit 0 (LSB, value 1): input value low, but not enough for warning
reg_tsurf_range	8-bit integer	None	Retrieved surface temperature check for regression retrieval product: bit 7: unused, set to zero; bit 6 (value 64): Invalid input; bit 5 (value 32): high input value error; bit 4 (value 16): low input value error; bit 3 (value 8): high input value warning; bit 2 (value 4): low input value warning; bit 1 (value 2): input value high, but not enough for warning; bit 0 (LSB, value 1): input value low, but not enough for warning
reg_tair_range	Profile range check (see below)	None	retrieved air temperature profile check for regression retrieval product
reg_h2ocd_range	Profile	None	retrieved water vapor temperature profile

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	range check (see below)		check for regression retrieval product
reg_ozocd_range	Profile range check (see below)	None	retrieved ozone temperature profile check for regression retrieval product
reg_cocd_range	Profile range check (see below)	None	retrieved CO temperature profile check for regression retrieval product
reg_ch4cd_range	Profile range check (see below)	None	retrieved methane temperature profile check for regression retrieval product
fin_psurf_range	8-bit integer	None	Surface pressure check for final retrieval product: bit 7: unused, set to zero; bit 6 (value 64): Invalid input; bit 5 (value 32): high input value error; bit 4 (value 16): low input value error; bit 3 (value 8): high input value warning; bit 2 (value 4): low input value warning; bit 1 (value 2): input value high, but not enough for warning; bit 0 (LSB, value 1): input value low, but not enough for warning
fin_tsurf_range	8-bit integer	None	Retrieved surface temperature check for final retrieval product: bit 7: unused, set to zero; bit 6 (value 64): Invalid input; bit 5 (value 32): high input value error; bit 4 (value 16): low input value error; bit 3 (value 8): high input value warning; bit 2 (value 4): low input value warning; bit 1 (value 2): input value high, but not enough for warning; bit 0 (LSB, value 1): input value low, but not enough for warning
fin_tair_range	Profile range check (see below)	None	retrieved air temperature profile check for final retrieval product
fin_tair_range_hi	Profile range check (see below)	None	retrieved air temperature profile check for final retrieval product above Press_mid_top_bndry

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fin_tair_range_mid	Profile range check (see below)	None	retrieved air temperature profile check for final retrieval product between Press_mid_top_bndry and Press_bot_mid_bndry
fin_tair_range_lo	Profile range check (see below)	None	retrieved air temperature profile check for final retrieval product below Press_bot_mid_bndry
fin_h2ocd_range	Profile range check (see below)	None	retrieved water vapor temperature profile check for final retrieval product
fin_ozocd_range	Profile range check (see below)	None	retrieved ozone temperature profile check for final retrieval product
fin_cocd_range	Profile range check (see below)	None	retrieved CO temperature profile check for final retrieval product
fin_ch4cd_range	Profile range check (see below)	None	retrieved methane temperature profile check for final retrieval product
CC1_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the first cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
CC1_Noise_Amp	32-bit floating-point	None	Internal retrieval quality indicator -- noise amplification factor from first cloud clearing because of extrapolation, dimensionless
Tsurf_4_CC1	32-bit floating-point	None	Internal retrieval quality indicator -- surface temperature used in first cloud clearing
TotCld_4_CC1	32-bit floating-point	None	Internal retrieval quality indicator -- total cloud fraction estimate before the first cloud clearing
CC1_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from first cloud clearing. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations

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CC2_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from second cloud clearing. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations
Phys_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from physical retrieval. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations
CCfinal_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the final cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
Tdiff_IR_MW_ret	32-bit floating-point	None	Internal retrieval quality indicator -- layer mean difference in lower atmosphere between final IR temperature retrieval and the last internal MW-only temperature determination. High values suggest problems with MW or problems with cloud clearing.
AMSU_Chans_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual of selected AMSU channels (currently channel 5 only) against that calculated from the final IR retrieval state, K. High values suggest lower atmosphere retrieval disagrees with MW due to problems with MW or cloud clearing.
TotCld_4_CCfinal	32-bit floating-point	None	Internal retrieval quality indicator -- total cloud fraction estimated before final cloud clearing (as seen from above), dimensionless between zero and one
TotCld_below_500mb	32-bit floating-point	None	Internal retrieval quality indicator -- estimated final cloud fraction due only to clouds below 500 mbar (as seen from above), dimensionless between zero and one
CCfinal_Noise_Amp	32-bit floating-point	None	Internal retrieval quality indicator -- noise amplification factor from final cloud clearing because of extrapolation, dimensionless
Surf_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of surface channels as compared to predicted uncertainty (dimensionless factor)
Temp_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of temperature channels as compared to predicted uncertainty (dimensionless factor)

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Phys_resid_AMSUA	32-bit floating-point	ChanAMSUA (= 15)	Residual for AMSU-A channels after final retrieval (K)
Phys_resid_IR_window_790	32-bit floating-point	None	Residual for IR window channel near 790 $\text{cm}^{-1}$ after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_844	32-bit floating-point	None	Residual for IR window channel near 844 $\text{cm}^{-1}$ after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_917	32-bit floating-point	None	Residual for IR window channel near 917 $\text{cm}^{-1}$ after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_1231	32-bit floating-point	None	Residual for IR window channel near 1231 $\text{cm}^{-1}$ after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_2513	32-bit floating-point	None	Residual for IR window channel near 2513 $\text{cm}^{-1}$ after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_2616	32-bit floating-point	None	Residual for IR window channel near 2616 $\text{cm}^{-1}$ after final retrieval (K) (No tuning applied because it is a surface channel)
CC1_sst1231r5	32-bit floating-point	None	Experimental cloud indicator #1 -- Initial cloud clearing surface temperature from BT(1231 $\text{cm}^{-1}$ ) assuming 0.98 emissivity. sst1231r5 should agree with surface temperature retrieval over ocean within 0.5 K.
CC1_d2392r1	32-bit floating-point	None	Experimental cloud indicator #2 -- Initial cloud clearing surface air temperature difference. Over ocean d2392r1 > -2.0 is a likely cloud-free spectrum.
CC1_dd12g5	32-bit floating-point	None	Experimental cloud indicator #3 -- Initial cloud clearing daytime gradient indicator BT(2616 $\text{cm}^{-1}$ ) - BT(1231 $\text{cm}^{-1}$ ) assuming 0.99 emissivity. Over ocean abs(dd12g5) < 0.5 is a likely cloud-free spectrum.
CC1_d12	32-bit floating-point	None	Experimental cloud indicator #4 -- Initial cloud clearing night gradient indicator BT(2616 $\text{cm}^{-1}$ ) - BT(1231 $\text{cm}^{-1}$ ) assuming 0.98 emissivity. At night over ocean abs(d12) < 0.25 indicates a cloud-free spectrum.
CC1_d23	32-bit floating-point	None	Experimental cloud indicator #5 -- Initial cloud clearing BT(1231 $\text{cm}^{-1}$ ) - BT(943 $\text{cm}^{-1}$ ) predictor for sensing thin cirrus and silicate dust. Over ocean abs(d23) > 0.25 K flags cirrus and/or silicate dust. Use in combination with d34 to discriminate silicate dust from cirrus.
CC1_d34	32-bit floating-point	None	Experimental cloud indicator #6 -- Initial cloud clearing BT(943 $\text{cm}^{-1}$ ) - BT(790 $\text{cm}^{-1}$ )

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	point		predictor for sensing thin cirrus. $\text{abs}(\text{d34}) > 0.5$ K indicates cirrus. Use in combination with d23.
CC1_lrt	32-bit floating-point	None	Experimental cloud indicator #7 -- Initial cloud clearing Lapse rate test. $\text{lrt} > 3.5$ K over tropical ocean indicates cloud-free data.
CC1_g5n	32-bit floating-point	None	Experimental cloud indicator #8 -- Initial cloud clearing Glint discriminator. Over ocean $\text{gn5} > 3$ indicates a spectrum distorted by a sun glint
CCN_sst1231r5	32-bit floating-point	None	Experimental cloud indicator #1 -- Final cloud clearing surface temperature from BT(1231 cm <sup>-1</sup> ) assuming 0.98 emissivity. $\text{sst1231r5}$ should agree with surface temperature retrieval over ocean within 0.5 K.
CCN_d2392r1	32-bit floating-point	None	Experimental cloud indicator #2 -- Final cloud clearing surface air temperature difference. Over ocean $\text{d2392r1} > -2.0$ is a likely cloud-free spectrum.
CCN_dd12g5	32-bit floating-point	None	Experimental cloud indicator #3 -- Final cloud clearing daytime gradient indicator $\text{BT}(2616 \text{ cm}^{-1}) - \text{BT}(1231 \text{ cm}^{-1})$ assuming 0.99 emissivity. Over ocean $\text{abs}(\text{dd12g5}) < 0.5$ is a likely cloud-free spectrum.
CCN_d12	32-bit floating-point	None	Experimental cloud indicator #4 -- Final cloud clearing night gradient indicator $\text{BT}(2616 \text{ cm}^{-1}) - \text{BT}(1231 \text{ cm}^{-1})$ assuming 0.98 emissivity. At night over ocean $\text{abs}(\text{d12}) < 0.25$ indicates a cloud-free spectrum.
CCN_d23	32-bit floating-point	None	Experimental cloud indicator #5 -- Final cloud clearing $\text{BT}(1231 \text{ cm}^{-1}) - \text{BT}(943 \text{ cm}^{-1})$ predictor for sensing thin cirrus and silicate dust. Over ocean $\text{abs}(\text{d23}) > 0.25$ K flags cirrus and/or silicate dust. Use in combination with d34 to discriminate silicate dust from cirrus.
CCN_d34	32-bit floating-point	None	Experimental cloud indicator #6 -- Final cloud clearing $\text{BT}(943 \text{ cm}^{-1}) - \text{BT}(790 \text{ cm}^{-1})$ predictor for sensing thin cirrus. $\text{abs}(\text{d34}) > 0.5$ K indicates cirrus. Use in combination with d23.
CCN_lrt	32-bit floating-point	None	Experimental cloud indicator #7 -- Final cloud clearing Lapse rate test. $\text{lrt} > 3.5$ K over tropical ocean indicates cloud-free data.
CCN_g5n	32-bit floating-point	None	Experimental cloud indicator #8 -- Final cloud clearing Glint discriminator. Over ocean $\text{gn5} > 3$ indicates a spectrum

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			distorted by a sun glint
CCR_pass_clear_tests	32-bit integer	None	Go/No go flag based on cloud cleared radiances. 1: Cloud cleared radiances have the same spectral properties as clear ocean Level-1B IR radiances; 0: Cloud cleared radiances do NOT have the same spectral properties as clear ocean Level-1B IR radiances; -9999: Unknown
totCldH2OStd	32-bit floating-point	None	Total cloud liquid water in kg/m**2
CC_noise_eff_amp_factor	32-bit floating-point	None	Effective amplification of noise in IR window channels due to extrapolation in cloud clearing and uncertainty of clear state. (< 1.0 for noise reduction, >1.0 for noise amplification, -9999.0 for unknown)
CC1_noise_eff_amp_factor	32-bit floating-point	None	Equivalent of CC_noise_eff_amp_factor but from the first attempt at cloud clearing
invalid	8-bit integer	None	No valid output (1: True, 0: False, 255/-1: Unknown)
all_spots_avg	8-bit integer	None	1: the cloud clearing step judged the scene to be clear enough that it averaged all spots' radiances; 0: cloud clearing was applied to the radiances; -1/255: cloud clearing not attempted
clear_lw_resid	8-bit integer	None	1: Low residuals of 800-900 cm-1 window channels indicate high likelihood scene is clear; 0: High residuals of 800-900 cm-1 window channels indicate low likelihood scene is clear; -1/255: cloud clearing not attempted
MW_ret_used	8-bit integer	None	MW-only final retrieval used
bad_clouds	8-bit integer	None	invalid cloud parameters
vis_clear	8-bit integer	None	at least 97.2% of each IR FOV within the AMSU FOV is clear sky
vis_cloudy	8-bit integer	None	at least 79.2% of each IR FOV within the AMSU FOV is cloudy
vis_low_cloud	8-bit integer	None	at least 79.2% of each IR FOV within the AMSU FOV is low_cloud
retrieval_type	8-bit integer	None	Deprecated -- use RetQAFlag. Retrieval type: 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed;

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			30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;
bad_l1b	8-bit integer	None	Level 2 process not allowed due to bad level 1b data
bad_l1b_amsu	8-bit integer	None	Bad AMSU-A level 1b data
bad_l1b_hsb	8-bit integer	None	Bad HSB level 1b data
bad_l1b_airs	8-bit integer	None	Bad AIRS level 1b data
bad_l1b_vis	8-bit integer	None	Bad VIS level 1b data
forecast	8-bit integer	None	Complete forecast guess was used
no_psurf_guess	8-bit integer	None	No surface pressure was available. Topography was used for surf press
bad_temps	8-bit integer	None	invalid temp and surface skin temp
bad_h2o	8-bit integer	None	invalid water vapor profile
bad_o3	8-bit integer	None	invalid ozone profile
bad_co	8-bit integer	None	Invalid CO profile (profiles with bad_co = 1 have successful physical retrieval of CO but unsuccessful physical retrieval overall. These have retrieved values in CO_PPBV but climatology COCDSup; those with bad_co = 2 have failed or not attempted physical CO retrieval and have -9999 in CO_PPBV and climatology in COCDSup)
bad_low_atm	8-bit integer	None	invalid result below 100 mbar
no_tuning	8-bit integer	None	Standard br temp tuning NOT applied
no_ang_corr	8-bit integer	None	Standard angle correction NOT applied
no_mw	8-bit integer	None	MW only retrieval not attempted
no_initial	8-bit integer	None	First retrieval not attempted
no_final	8-bit integer	None	Final retrieval not attempted

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mw_fpe	8-bit integer	None	floating-point exception in MW retrieval step
initial_fpe	8-bit integer	None	floating-point exception in Initial retrieval step
final_fpe	8-bit integer	None	floating-point exception in Final retrieval step
MWPrecip	8-bit integer	None	Precipitation was detected over 0.5 mm/hr
MWsurf_T0	32-bit floating-point	None	low-frequency surface adjustment parameter -- T0
MWsurf_Tinf	32-bit floating-point	None	high-frequency surface adjustment parameter -- Tinfinity
MWsecant_ratio	32-bit floating-point	None	ratio of reflected to direct path length (only valid for mostly-water scenes)
MWseaice_conc	32-bit floating-point	None	Fraction of field-of-view with frozen covering. For predominately water areas (landFrac < 0.5, MWSurfClass = 3,4) MWseaice_conc refers to sea ice and MWseaice_conc range is [0.05 ... (1.0 - landFrac)]. For predominately land areas (landFrac >= 0.5, MWSurfClass = 5,6,7) MWseaice_conc refers to snow/glacier and MWseaice_conc range is [0.0 ... 1.0]. Frozen surface of the minority element of a coastal field-of-view is not accounted for. Other surface classes have MWseaice_conc=0.0
MWresidual_temp	32-bit floating-point	None	sum of squares of temperature residuals normalized by channel sensitivities
MWresidual_mois	32-bit floating-point	None	sum of squares of moisture residuals normalized by channel sensitivities
MWresidual_AMSUA	32-bit floating-point	ChanAMSUA (= 15)	Brightness temperature residual for each AMSU-A channel (Kelvin)
MWresidual_HSB	32-bit floating-point	ChanHSB (= 5)	brightness temperature residual for each HSB channel (Kelvin)
MWiter_temp	8-bit integer	None	# of iterations of the temperature profile
MWiter_mois	8-bit integer	None	# of iterations of the moisture profile
mw_ret_code	8-bit integer	None	Return code status of MW retrieval: values can be summed if more than one applies: 0 all OK; 1 moisture variables rejected by residual

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			test; 2 temperature profile rejected by residual test; 4 excessive liquid water; 8 insufficient valid channels; 16 numerical error; 32 emissivity > 1 for any AMSU-A channel
cloud_ice	8-bit integer	None	Scattering by cloud ice present in FOV
icc_too_cloudy	8-bit integer	None	Initial cloud clearing pass too cloudy
icc_low_contrast	8-bit integer	None	Initial cloud clearing pass contrast too low
icc_bad_rad	8-bit integer	None	Initial cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval
icc_contrast	32-bit floating-point	None	Initial cloud clearing contrast (units?)
bad_1st	8-bit integer	None	The initial retrieval failed
bad_1st_surf	8-bit integer	None	The initial surface retrieval failed
bad_1st_cc	8-bit integer	None	The first cloud clearing failed
bad_1st_regres	8-bit integer	None	The regression guess failed
bad_1st_phys	8-bit integer	None	The first physical retrieval failed
fcc_too_cloudy	8-bit integer	None	Final cloud clearing pass too cloudy
fcc_low_contrast	8-bit integer	None	Final cloud clearing pass contrast too low
fcc_bad_rad	8-bit integer	None	Final cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval
fcc_contrast1	32-bit floating-point	None	Final cloud clearing contrast (units?) pass 1
fcc_contrast2	32-bit floating-point	None	Final cloud clearing contrast (units?) pass 2
bad_final	8-bit integer	None	Final retrieval failed
bad_final_cc	8-bit integer	None	final cloud clearing failed
bad_final_ir	8-bit integer	None	final IR retrieval failed

## A1-9. L2 Support Atmospheric/Surface Product Interface Specification

bad_final_surf	8-bit integer	None	final surface ret failed
bad_final_temp	8-bit integer	None	final temp ret failed
bad_final_h2o	8-bit integer	None	final water vapor ret failed
bad_final_o3	8-bit integer	None	final ozone ret failed
bad_final_cloud	8-bit integer	None	final cloud ret failed
bad_cc_cld_ret	8-bit integer	None	Cloud clearing and cloud ret are inconsistent
MW_IR_ret_differ	8-bit integer	None	Microwave and IR temperature retrieval differ too much - reject final IR retrieval
bad_MW_low_resid	8-bit integer	None	Microwave residuals in lower atmosphere too large - reject final IR retrieval
MW_low_atm_resid	32-bit floating-point	None	MW residual for lower atmosphere after final retrieval
final_AMSU_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_HSB_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_cloud_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_surf_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_temp_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_h2o_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_o3_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_ch4_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_co_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large
final_co2_ret	8-bit integer	None	0 for success; 1 for did not converge;

## A1-9. L2 Support Atmospheric/Surface Product Interface Specification

			2 for residual too large
low_sun	8-bit integer	None	solar zenith angle > 60 degrees
wide_ang	8-bit integer	None	viewing angle at center of AIRS spot > 50 degrees
vis_glnt	8-bit integer	None	sun-glnt is expected to alter radiances for any water surfaces in the AMSU FOV by at least 5%. (No test is made, however, for whether any water is actually located within the FOV.)
bad_vis_rad	8-bit integer	None	Vis/NIR radiance out of range
bad_vis_cal	8-bit integer	None	Vis/NIR calibration data old or invalid
bad_vis_det_temp	8-bit integer	None	Vis/NIR Detector temperature out of range
bad_scan_hd_temp	8-bit integer	None	Scan Head Assembly temperature out of range
bad_vis_cld_det	8-bit integer	None	Cloud detection failed
bad_vis_cld_hgt	8-bit integer	None	Cloud height failed
bad_ref_NDVI	8-bit integer	None	Bad reference Normalized Differential Vegetation Index
bad_vis_var	8-bit integer	None	Variability index invalid
Initial_CC_score	32-bit floating-point	None	Indicator of how well the initial cloud-cleared radiances match radiances reconstructed from clear eigenvectors. (Unitless ratio; 0.33 is best possible, a 3X noise reduction; <0.8 for a very good match; <3.0 for a pretty good match; >10.0 indicates a major problem)
Initial_CC_subscores	32-bit floating-point	ScoresBand (= 10)	Sub-scores contributing to Initial_CC_score, by frequency band
MODIS_emis	32-bit floating-point	MODISEmisBand (= 6)	First guess emissivity from MODIS (AMSU resolution)
MODIS_emis_dev	32-bit floating-point	MODISEmisBand (= 6)	Standard Deviation among the MODIS elements used to determine MODIS_emis (AMSU resolution)
MODIS_emis_spots	32-bit floating-point	MODISEmisBand (= 6) * AIRSTrack (= 3) * AIRSXTrack (= 3)	First guess emissivity from MODIS (AMSU resolution)
MODIS_emis_spots_dev	32-bit floating-point	MODISEmisBand (= 6) *	Standard Deviation among the MODIS elements used to determine MODIS_emis

## A1-9. L2 Support Atmospheric/Surface Product Interface Specification

	point	AIRSTrack (= 3) * AIRSXTrack (= 3)	(AMSU resolution)
--	-------	---------------------------------------	-------------------

Size: 22396500 bytes (22.4 MB) per 45-scanset granule

**Total File Size (plus storage for dimensions and other HDF-EOS overhead):  
22432343 bytes (22.4 MB) per 45-scanset granule = 5383.8 MB per day**

### Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "flags" of AIRS field "MW\_tair\_range" involves reading HDF-EOS Swath field "MW\_tair\_range.flags".

Profile range check: This type provides information about how many levels of a profile are how far out of the bounds over which the algorithm is validated.

Field Name	Type	Explanation
flags	8-bit unsigned integer	bit 7: unused, set to zero; bit 6 (value 64): Invalid input; bit 5 (value 32): high input value error; bit 4 (value 16): low input value error; bit 3 (value 8): high input value warning; bit 2 (value 4): low input value warning; bit 1 (value 2): input value high, but not enough for warning; bit 0 (LSB, value 1): input value low, but not enough for warning
num_hi_50	8-bit unsigned integer	Number of levels at least 50% above valid range
num_lo_50	8-bit unsigned integer	Number of levels at least 50% below valid range
num_hi_25	8-bit unsigned integer	Number of levels at least 25% but not more than 50% above valid range
num_lo_25	8-bit unsigned integer	Number of levels at least 25% but not more than 50% below valid range
num_hi_10	8-bit unsigned integer	Number of levels at least 10% but not more than 25% above valid range
num_lo_10	8-bit unsigned integer	Number of levels at least 10% but not more than 25% below valid range
num_bad	8-bit unsigned integer	Number of invalid levels
worst_case	32-bit floating-point	Percentage out of range (logarithmic) of worst case.; Positive when worst case is above validated range; negative when worst case is below validated range; zero when all elements are in range.

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## Appendix A2. Summary Browse Product Interface Specifications

AIRS Browse products are used as an aid to ordering AIRS data from the DAAC via the EOS Data Gateway (EDG). The user cycles through the AIRS Browse images for a high-level view of AIRS data products. The user may order AIRS science granules that correspond to features found in the browse images.

The AIRS Summary browse products represent a twice-daily global snapshot of one day's AIRS observations. The daily browse products will have "gores" between the satellite paths where there is no coverage for that day.

Each summary browse product file consists of several unsigned 8-bit arrays. Each array is a 180 x 360 two-dimensional global map of the Earth's surface at 1° x 1° resolution using a rectilinear projection. Each grid cell is a 1° x 1° square bounded by latitude and longitude lines. The longitudinal extent is from -180.0° to +180.0° with the prime meridian in the center of the image. The files are in HDF RIS8 (8-bit raster) format, and for each image within the file there is an associated color palette. Additionally, for each image there are descriptive annotations in HDF DFAN format. The annotations consist of image title, image description, and the minimum, mean, and maximum of the original data values and the corresponding pixel values. The minimum and maximum of the original data values may be used to annotate a color bar.

Each array element has a value between 0 and 199 and is a re-scaled representation of a floating-point number (visible images are integer). The relationship between pixel value (pv) and input floating point data value (dv) is:

$$pv = (dv - \text{minimum\_dv}) * (199 / (\text{maximum\_dv} - \text{minimum\_dv})) + 1$$

The AIRS summary browse product consists of five (5) summary browse package types, separated for ascending or descending orbital passes. A total of ten (10) AIRS summary browse package files are produced once per day. The products are associated with AIRS processing levels and instrument outputs of the AIRS science granules. The five AIRS summary product package types are described below.

### 1. **AIRHBDBR** - HSB Level 1B summary browse package type

AIRHBDBR consists of pixel representations of HSB Level 1B calibrated observed brightness temperatures. A limb adjustment algorithm is applied before the data values are converted to pixel values. AIRHBDBR contains 4 image arrays corresponding to 4 HSB channels ( $f_0 = 183.31$  GHz):

- 150.0 GHz (HSB Channel 2)
- $f_0 \pm 1.0$  GHz (HSB Channel 3)
- $f_0 \pm 3.0$  GHz (HSB Channel 4)
- $f_0 \pm 7.0$  GHz (HSB Channel 5)

### 2. **AIRABDBR** - AMSU-A Level 1B summary browse package type

AIRABDBR consists of pixel representations of AMSU-A Level 1B calibrated observed brightness temperatures. AIRABDBR is limb adjusted. AIRABDBR contains 8 image arrays corresponding to 8 AMSU-A channels (Center freq. GHz):

## Appendix A2. Summary Browse Product Interface Specifications

- 23.8 GHz (AMSU-A Channel 1)
- 31.4 GHz (AMSU-A Channel 2)
- 50.3 GHz (AMSU-A Channel 3)
- 52.8 GHz (AMSU-A Channel 4)
- 53.596 +/- .115 GHz (AMSU-A Channel 5)
- 54.4 GHz (AMSU-A Channel 6)
- 54.94 GHz (AMSU-A Channel 7)
- 89.0 GHz (AMSU-A Channel 15)

### 3. **AIRIBDBR** - AIRS Level 1B summary browse package type

AIRIBDBR consists of pixel representations of AIRS Level 1B calibrated observed radiances that have been converted to brightness temperature to increase the range of values. No limb adjustment is applied. AIRIBDBR contains 4 image arrays corresponding to 4 AIRS channels:

- 709.74 (200 mb temperature sensing channel)
- 1040.14 (ozone sensing channel)
- 1109.49 (window channel)
- 1310.06 (water vapor sensing channel)

If, for any reason, any of the primary channels above are not available, each of the channels has a secondary option. The secondary channels are: 702.86, 1036.45, 1103.24, and 1330.90.

### 4. **AIRI2DBR** - AIRS Level 2 cloud-cleared radiance summary browse package type

AIRI2DBR consists of pixel representations of selected AIRS Level 2 cloud cleared radiances that have been converted to brightness temperature to increase the range of values. No limb adjustment is applied. The cloud-cleared radiance product is the infrared radiance emitted from cloud-free retrieved profiles,  $\text{mWm}^2/\text{cm}^2\text{-1/steradian}$ . A single spectrum is derived from a suite of nine AIRS infrared spectra, nine HSB spectra and one AMSU-A spectrum. AIRI2DBR contains 4 image arrays corresponding to 4 AIRS channels:

- 709.74 (200 mb temperature sensing channel)
- 1040.14 (ozone sensing channel)
- 1109.49 (window channel)
- 1310.06 (water vapor sensing channel)

If, for any reason, any of the primary channels above are not available, each of the channels has a secondary option. The secondary channels are: 702.86, 1036.45, 1103.24, and 1330.90.

### 5. **AIRX2DBR** - Level 2 retrieval summary browse package type

AIRX2DBR consists of pixel representations of selected AIRS Level 2 retrieved quantities. AIRX2DBR consists of 8 image arrays for ascending (daytime) nodes or 6 images for descending (night time) nodes for the following retrieved products:

- Cloud Fraction

## Appendix A2. Summary Browse Product Interface Specifications

- Skin Surface Temperature (SST)
- Total Water Vapor Burden
- Total Ozone Burden
- Microwave First Guess Liquid Water
- Visible Percent Clear (Ascending Node Only)

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## Appendix A3. Level 3 Standard Product Interface Specification

Interface Specification Version 4.0.9.0  
2005-02-01

ESDT ShortName="AIRX3STD", "AIRX3ST8", "AIRX3STM"

Grid Names = "location", "ascending", "descending", "ascending\_MW\_only",  
"descending\_MW\_only"

Level="level3"

Horizontal resolution= 1°x1° degree (360x180)

Upper Left Point= -180.0, 90.0

Lower Right Point= 180.0, -90.0

Projection= GCTP\_GEO

### Geolocation Fields

These fields are within the location grid and document pertinent information for determining the location and characteristics of a given grid cell.

Name	Type	Extra Dimensions	Explanation
Latitude	32-bit floating-point	None	Array of 360 x 180 latitude values at the center of the grid box (Degrees).
Longitude	32-bit floating-point	None	Array of 360 x 180 longitude values at the center of the grid box (Degrees).
LandSeaMask	16-bit integer	None	Land sea mask. 1 = land, 0 = ocean. (Unitless)

### Attributes

These fields appear once per Level 3 granule.

Name	Type	Extra Dimensions	Explanation
NumOfDays	32-bit integer	None	Total number of days of input Level 2 data included in gridded maps.
AscendingGridStartTimeUTC	String of 8-bit characters	None	Begin time of mapped fields (UTC), ascending.
AscendingGridEndTimeUTC	String of 8-bit characters	None	End time of mapped fields (UTC), ascending.
DescendingGridStartTimeUTC	String of 8-bit characters	None	Begin time of mapped fields (UTC), descending.
DescendingGridEndTimeUTC	String of 8-bit characters	None	End time of mapped fields (UTC), descending.
TempPresLvlNum	32-bit floating point	24	Standard pressure (mb) for each of 24 levels in the atmosphere associated with temperature profiles and geopotential height. The array order is from the surface upward, in conformance with WMO standard. Note that the Level-3 pressure levels are a subset of Level-2 pressure levels and are constrained to begin at 1000.0 mb and end at 1.0 mb.
H2OpresLvlNum	32-bit floating point	12	Standard pressure (mb) for each of 12 layers in the atmosphere associated with AIRS Level-3 water vapor

### A3. Level 3 Standard Product Interface Specification

			profiles. The array order is from surface upward in accordance with the WMO standard. Note that Level-3 pressure levels for water vapor are constrained to be between 1000.0 and 100.0 mb.
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### Ascending and Descending Grid Fields

These fields (data, counts and standard deviation) appear once per ascending or descending grid. The ‘\_A’ or ‘\_D’ following a parameter name identifies the orbital node (A=ascending, D=descending) and thus, the grid. The exception is the visible cloud fraction and associated counts and standard deviation. The visible cloud fraction is found only in the ascending grid.

Name	Type	Extra Dimensions	Explanation
TotalCounts_A TotalCounts_D	16-bit integer	None	Total counts of all points that fell within a 1°x1° grid cell whether they were included in the final L3 product or not. Used for QC.
TotCldLiqH2O_A TotCldLiqH2O_D	32-bit floating point	None	Total integrated column cloud liquid water. (kg/m <sup>2</sup> )
TotCldLiqH2O_A_sdev TotCldLiqH2O_D_sdev	32-bit floating point	None	Standard deviation for cloud liquid water. (kg/m <sup>2</sup> )
TotCldLiqH2O_A_ct TotCldLiqH2O_D_ct	16-bit integer	None	Number of input points for cloud liquid water per 1°x1° grid cell. (Count)
TotH2OVap_A TotH2OVap_D	32-bit floating point	None	Total integrated column water vapor burden. (kg/m <sup>2</sup> )
TotH2OVap_A_sdev TotH2OVap_D_sdev	32-bit floating point	None	Standard deviation for precipitable water. (kg/m <sup>2</sup> )

### A3. Level 3 Standard Product Interface Specification

TotH2OVap_A_ct TotH2OVap_D_ct	16-bit integer	None	Number of input points for precipitable water per 1°x1° grid cell. (Count)
TotO3_A TotO3_D	32-bit floating point	None	Total integrated column ozone burden. (Dobson units)
TotO3_A_sdev TotO3_D_sdev	32-bit floating point	None	Standard deviation for total ozone. (Dobson units)
TotO3_A_ct TotO3_D_ct	16-bit integer	None	Number of input points for total ozone per 1°x1° grid cell. (Count)
SurfAirTemp_A SurfAirTemp_D	32-bit floating point	None	Temperature of the atmosphere at the Earth's surface. (Kelvin)
SurfAirTemp_A_sdev SurfAirTemp_D_sdev	32-bit floating point	None	Standard deviation for atmospheric surface temperature. (Kelvin)
SurfAirTemp_A_ct SurfAirTemp_D_ct	16-bit integer	None	Number of input points for atmospheric surface temperature per 1°x1° grid cell. (Count)
SurfSkinTemp_A SurfSkinTemp_D	32-bit floating point	None	Surface skin temperature. (Kelvin)
SurfSkinTemp_A_sdev SurfSkinTemp_D_sdev	32-bit floating point	None	Standard deviation for surface skin temperature. (Kelvin)
SurfSkinTemp_A_ct SurfSkinTemp_D_ct	16-bit integer	None	Number of input points for surface skin temperature per 1°x1° grid cell. (Count)
SurfPres_A SurfPres_D	32-bit floating point	None	Mean surface pressure. (mb)
SurfPres_A_sdev SurfPres_D_sdev	32-bit floating point	None	Standard deviation for surface pressure. (mb)
SurfPres_A_ct SurfPres_D_ct	16-bit integer	None	Number of input points for mean surface pressure per 1°x1° grid cell. (Count)
OLR_A OLR_D	32-bit floating point	None	Outgoing long-wave radiation flux. (watts/m <sup>2</sup> )
OLR_A_sdev OLR_D_sdev	32-bit floating point	None	Standard deviation for outgoing long-wave radiation. (watts/m <sup>2</sup> )
OLR_A_ct OLR_D_ct	16-bit integer	None	Number of input points for outgoing log-wave radiation per 1°x1° grid cell. (Count)

### A3. Level 3 Standard Product Interface Specification

ClrOLR_A ClrOLR_D	32-bit floating point	None	Clear-sky outgoing long-wave radiation flux. (watts/m <sup>2</sup> )
ClrOLR_A_sdev ClrOLR_D_sdev	32-bit floating point	None	Standard deviation for clear-sky outgoing long-wave radiation. (watts/m <sup>2</sup> )
ClrOLR_A_ct ClrOLR_D_ct	16-bit integer	None	Number of input points for clear-sky outgoing log-wave radiation per 1°x1° grid cell. (Count)
EmisIR_A EmisIR_D	32-bit floating point	4	IR surface emissivity on a frequency grid (832, 961, 1203, 2616 cm-1.)
EmisIR_A_sdev EmisIR_D_sdev	32-bit floating point	4	Standard deviation for IR surface emissivity. (832, 961, 1203, 2616 cm-1.)
EmisIR_A_ct EmisIR_D_ct	16-bit integer	4	Number of input points for IR surface emissivity per 1°x1° grid cell and for each frequency grid point. (Count)
GPHeight_A GPHeight_D	32-bit floating point	24	Geopotential height in meters at 24 standard pressure levels from 1000. to 1.0 mb. (Meters)
GPHeight_A_sdev GPHeight_D_sdev	32-bit floating point	24	Standard deviation for Geopotential height. (Meters)
GPHeight_A_ct GPHeight_D_ct	16-bit integer	24	Number of input points for geopotential height per 1°x1° grid cell and at each pressure level. (Count)
CldFrc_A CldFrc_D	32-bit floating point	None	Combined layer cloud fraction. (0-1). (Unitless)
CldFrc_A_sdev CldFrc_D_sdev	32-bit floating point	None	Standard deviation of combined layer cloud fraction. (Unitless)
CldFrc_A_ct CldFrc_D_ct	16-bit integer	None	Number of input points for cloud fraction per 1°x1° grid cell. (Count)
CloudTopPres_A CloudTopPres_D	32-bit floating point	None	Combined cloud top pressure (weighted by cloud fraction). (mb)
CloudTopPres_A_sdev CloudTopPres_D_sdev	32-bit floating point	None	Standard deviation of combined cloud top pressure. (mb)
CloudTopPres_A_ct	16-bit integer	None	Number of input points for

### A3. Level 3 Standard Product Interface Specification

CloudTopPres_D_ct			cloud pressure per 1°x1° grid cell. (Count)
RelHumid_A RelHumid_D	32-bit floating point	12	Relative humidity profile in 12 Standard pressure levels from 1000. to 100. mb. (Percent)
RelHumid_A_sdev RelHumid_D_sdev	32-bit floating point	12	Standard deviation for relative humidity profiles. (Percent)
RelHumid_A_ct RelHumid_D_ct	16-bit integer	12	Number of input points for relative humidity profiles per 1°x1° grid cell and at each pressure level. (Count)
H2OVapMMR_A H2OVapMMR_D	32-bit floating point	12	Water vapor mass mixing ratio at 12 standard pressure levels from 1000. to 100. mb (gm/kg dry air)
H2OVapMMR_A_sdev H2OVapMMR_D_sdev	32-bit floating point	12	Standard deviation for water vapor mass mixing ratio. (gm/kg dry air)
H2OVapMMR_A_ct H2OVapMMR_D_ct	16-bit integer	12	Number of input points for water vapor mass mixing ratio per 1°x1° grid cell and at each pressure level. (Count)
Temperature_A Temperature_D	32-bit floating point	24	Atmospheric temperature profile in 24 standard pressure levels from 1000. to 1.0 mb. (Kelvin)
Temperature_A_sdev Temperature_D_sdev	32-bit floating point	24	Standard deviation for Temperature profiles. (Kelvin)
Temperature_A_ct Temperature_D_ct	16-bit integer	24	Number of input points for temperature profiles per 1°x1° grid cell and at each pressure level. (Count)
Cloud_Frc_Vis_A	32-bit floating point	None	Fraction of visible pixels. Ascending nodes only. (Unitless)
Cloud_Frc_Vis_A_sdev	32-bit floating point	None	Standard deviation for Cloud_Frc_Vis_A.
Cloud_Frc_Vis_A_ct	16-bit integer	None	Number of input points for visible cloud fraction per 1°x1° grid cell.

### Microwave-only Ascending and Descending Grid Fields

These fields (data, counts and standard deviation) appear once per ascending or descending grid. The ‘\_A’ or ‘\_D’ following a parameter name identifies the orbital node (A=ascending, D=descending) and thus, the grid.

Name	Type	Extra Dimensions	Explanation
TotalCounts_MW_A TotalCounts_MW_D	16-bit integer	None	Total counts of all points that fell within a 1°x1° grid cell whether they were included in the final L3 product or not. Used for QC.
TotH2O_Vap_MW_A TotH2O_Vap_MW_D	32-bit floating point	None	Total integrated column water vapor burden. (kg/m <sup>2</sup> )
TotH2O_Vap_MW_A_sdev TotH2O_Vap_MW_D_sdev	32-bit floating point	None	Standard deviation for total integrated column water vapor burden. (kg/m <sup>2</sup> )
TotH2O_Vap_MW_A_ct TotH2O_Vap_MW_D_ct	16-bit integer	None	Number of input points for total integrated column water vapor burden 1°x1° grid cell. (Count)
EmisMW_MW_A EmisMW_MW_D	32-bit floating point	3	Microwave spectral emissivity on a frequency grid (23.8, 50.3 and 89.0 GHz).
EmisMW_MW_A_sdev EmisMW_MW_D_sdev	32-bit floating point	3	Standard deviation for microwave spectral emissivity.
EmisMW_MW_A_ct EmisMW_MW_D_ct	16-bit integer	3	Number of input points for microwave spectral emissivity per 1°x1° grid cell and frequency grid point. (Count)
GPHeight_MW_A GPHeight_MW_D	32-bit floating point	24	Microwave-only geopotential height in meters at 24 standard pressure levels from 1000. to 1.0 mb.

### A3. Level 3 Standard Product Interface Specification

			(Meters)
GPHeight_MW_A_sdev GPHeight_MW_D_sdev	32-bit floating point	24	Standard deviation for microwave-only geopotential height. (Meters)
GPHeight_MW_A_ct GPHeight_MW_D_ct	16-bit integer	24	Number of input points for geopotential height per 1°x1° grid cell and at each pressure level. (Count)
Temperature_A Temperature_D	32-bit floating point	24	Microwave-only atmospheric temperature profile in 24 standard pressure levels from 1000. to 1.0 mb. (Kelvin)
Temperature_A_sdev Temperature_D_sdev	32-bit floating point	24	Standard deviation for microwave-only temperature profiles. (Kelvin)
Temperature_A_ct Temperature_D_ct	16-bit integer	24	Number of input points for temperature profiles per 1°x1° grid cell and at each pressure level. (Count)

### A3. Level 3 Standard Product Interface Specification

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## Appendix B. AIRS Filenames and Local Granule ID (LGID) Convention

AIRS filenames correspond to the "identifier" portion of the ECS Local Granule ID (LGID) standard:

LGID:shortname:version:identifier

where:

":" is a colon that acts as a separator of the parts of the LGID

"LGID" is a literal string

"shortname" is the ECS ESDT shortname

"version" is the ECS ESDT version

"identifier" is

AIRS.yyyy.mm.dd.ggg.Lev.Instr\_Prod.vm.m.r.b.lvid.Fttttttttt.ext  
as detailed below

We'll use identifiers of:

AIRS.yyyy.mm.dd.ggg.Lev.Instr\_Prod.vm.m.r.b.lvid.Fttttttttt.ext

Making the whole LGID:

LGID:shortname:version:AIRS.yyyy.mm.dd.ggg.Lev.Instr\_Prod.vm.m.r.b.lvid.Fttttttttt.ext

where:

AIRS is the literal string "AIRS" to identify this as  
an AIRS-instrument-suite product.

yyyy.mm.dd is the year/month/day of the start of the granule.

ggg is the granule number in day (001 - 240).

Note: Granule number is omitted for daily and multiday products .

For browse products (L1B.Browse\_AMSU, L1B.Browse\_HSB, L1B.Browse\_AIRS, L2.Browse\_Ret, L2.Browse\_CC) it is replaced by a single-character node-type identifier:

"A" for Ascending

"D" for Descending

For L3 products (L3) there is no replacement.

Note: The numbering system from 001 - 240 is closely tied to the idea of 6-minute granules triggered at precise intervals keyed to total elapsed time since start of year 1958. Test granules have been produced with

## Appendix B. AIRS Filenames and Local Granule ID (LGID) Convention

granule numbers outside of this interval or with granule numbers in range but without the corresponding start and end times. These granules are not supported.

Lev is processing level:

"L1B", "L2", or "L3".

Instr is instrument name:

"AMSU" for AMSU-A

"HSB" for HSB

"VIS" for Vis channels of AIRS when there is a separate

Vis product

"AIRS" for AIRS/IR \*or\* AIRS/IR + AIRS/Vis

Omitted for Daily & L2 products

Prod is descriptor of product:

For L1B:

"Rad" for science radiances (including MW instruments  
where radiances are in units of brightness temperature)

"QaSub" for QA subsets

"Browse\_AIRS", "Browse\_AMSU", and "Browse\_HSB" (includes "Instr")  
for daily browse packages

For L2:

"CC" for cloud-cleared AIRS radiances

"RetStd" for standard retrieval product

"RetSup" for support retrieval product

"Browse\_Ret" for daily retrieval browse packages

"Browse\_CC" for cloud-cleared daily browse packages

For L3:

"RetStdxxx" for standard L3 retrieval products

vm.m.r.b is the PGEVersion uniquely identifying a configuration of source code + static ancillary files. "v" is the literal character 'v'. It is followed by four numbers separated by three "."s. These are the major & minor version numbers, a release number, and a build number. Example: "v4.0.9.0" is the official (.0) build of release 9 of version 4.0.

lvid is the LocalVersionID. This field is optional and usually absent.

L2 and L3 products in collection 4 produced using HSB data include a LocalVersionID of "HSB".

F is processing facility ID:

"G" for GSFC DAAC

"A" for AIRS TLSCF official TDS processing

"T" for AIRS TLSCF official testing

"S" for AIRS TLSCF officially sanctioned simulation

## Appendix B. AIRS Filenames and Local Granule ID (LGID) Convention

"D" for any direct broadcast station

"N" for NOAA NESDIS

"X" for anything else

tttttttt is AIRS run tag (00000000000 - 99999999999).

This field is designed to ensure LocalGranuleIDs are unique, even when the same software is used to reprocess the same data. It is local processing time as yyyydoyhhmmss. (year, doy-of-year (julian day), hour, minute, second).

Note: this corresponds to metadata PSA AIRSRunTag.

ext is the filetype extension:

".hdf" for all HDF products (including HDF-EOS)

".txt" for all text products

Note: when optional fields are absent only one "." appears, never two in a row. Trailing "."s are also omitted.

Here's a full set (one of each type):

Produced by Level-1B PGEs:

AIRS.2001.12.03.131.L1B.AMSU\_Rad.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.131.L1B.HSB\_Rad.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.131.L1B.AIRS\_Rad.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.131.L1B.AIRS\_QaSub.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.131.L1B.VIS\_Rad.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.131.L1B.VIS\_QaSub.v4.0.9.0.G2002123120634.hdf

Produced by Level-1B Summary Browse PGEs:

AIRS.2001.12.03.A.L1B.Browse\_AMSU.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.A.L1B.Browse\_HSB.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.A.L1B.Browse\_AIRS.v4.0.9.0.G2002123120634.hdf

Produced by Level-2 Retrieval PGE:

AIRS.2001.12.03.131.L2.CC.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.131.L2.RetStd.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.131.L2.RetSup.v4.0.9.0.G2002123120634.hdf

Produced by L3 Daily PGE:

AIRS.2001.12.03.L3.RetStd001.v4.0.9.0.G2002123120634.hdf

Produced by L3 Multiday PGEs:

AIRS.2001.12.03.L3.RetStd008.v4.0.9.0.G2002123120634.hdf

Produced by L3 Monthly PGEs:

AIRS.2001.12.01.L3.RetStd031.v4.0.9.0.G2002123120634.hdf

## Appendix B. AIRS Filenames and Local Granule ID (LGID) Convention

Produced by Level-2 Summary Browse PGEs:

AIRS.2001.12.03.A.L2.Browse\_Ret.v4.0.9.0.G2002123120634.hdf

AIRS.2001.12.03.A.L2.Browse\_CC.v4.0.9.0.G2002123120634.hdf

## Appendix C-1. AIRS Products

### Appendix C-1. AIRS Products

ESDT Short Name	Sample File Name (Local Granule ID)	Instr.	File Size Per Granule (MB)	Files Per Day	Daily Rate (MB per Day)	Description
RHBRAD	AIRS.2002.09.06.001.L1B.HSB_Rad.v4.0.9.0.G02108051208.hdf	HSB	1.4	240	334.3	HSB L1B Radiances-HDF: HSB geolocated & calibrated brightness temp. in Kelvin
RABRAD	AIRS.2002.09.06.001.L1B.AMSU_Rad.v4.0.9.0.G02108050637.hdf	AMSU-A	0.3	240	75.2	AMSU-A L1B Radiances-HDF: AMSU-A1 & AMSU-A2 combined, geolocated & calibrated brightness temp. in Kelvin
IRIBRAD	AIRS.2002.09.06.001.L1B.AIRS_Rad.v4.0.9.0.G02108054232.hdf	AIRS	60	240	13800	AIRS L1B Radiances-HDF: AIRS IR Geolocated Radiances in Watts/cm**2/micron/steradian
IRIBQAP	AIRS.2002.09.06.001.L1B.AIRS_QaSub.v4.0.9.0.G02108054232.hdf	AIRS	5.5	240	1323.8	AIRS L1B QA Product Output
RVBRAD	AIRS.2002.09.06.001.L1B.VIS_Rad.v4.0.9.0.G02108053937.hdf	AIRS	16.6	240	3987.9	VIS L1B Radiances-HDF: VIS Geolocated Radiances in Watts/cm**2/micron/steradian
RVBQAP	AIRS.2002.09.06.001.L1B.VIS_QaSub.v4.0.9.0.G02108053937.hdf	AIRS	0.9	240	225.1	VIS L1B QA Product Output
IRX2RET	AIRS.2002.09.06.001.L2.RetStd.v4.0.9.0.G02108055444.hdf	AIRS-Suite	54	240	1295	AIRS L2 Standard Retrieval Product

## Appendix C-1. AIRS Products

IRI2CCF	AIRS.2002.09.06.001.L2.CC.v4.0.9.0.G02108055444.hdf	AIRS-Suite	10	240	2507	AIRS L2 Cloud-Cleared Radiance Product
IRX2SUP	AIRS.2002.09.06.001.L2.RetSup.v4.0.9.0.G02108055444.hdf	AIRS-Suite	20	240	4740	AIRS L2 Support Product
RHBDBR	AIRS.2002.09.06.A.L1B.Browse_HSB.v4.0.9.0.G02108051352.hdf	HSB	0.3	2	0.6	HSB Daily Browse Package – Ascending & Descending
RABDBR	AIRS.2002.09.06.A.L1B.Browse_AMSU.v4.0.9.0.G02108050955.hdf	AMSU-A	0.6	2	1.2	AMSU-A Daily Browse Package – Ascending & Descending
IRIBDBR	AIRS.2002.09.06.A.L1B.Browse_AIRS.v4.0.9.0.G02108054749.hdf	AIRS	0.4	2	0.8	AIRS Daily Browse Package – Ascending & Descending
IRX2DBR	AIRS.2002.09.06.A.L2.Browse_Ret.v4.0.9.0.G02108061810.hdf	AIRS-Suite	0.5	2	1.0	L2 Retrieval Daily Browse Package – Ascending & Descending
IRI2DBR	AIRS.2002.09.06.A.L2.Browse_CC.v4.0.9.0.G02108061724.hdf	AIRS	0.4	2	0.8	L2 Cloud-Cleared Radiance Daily Browse Package – Ascending & Descending
IRX3STD	AIRS.2002.09.06.L3.RetStd001.v4.0.9.0.G05031160923.hdf	AIRS-Suite	50	1	50	L3 Standard Daily Product
IRX3ST8	AIRS.2002.09.06.L3.RetStd008.v4.0.9.0.G05031160923.hdf	AIRS-Suite	50	1/8	7	L3 Standard Multiday (8-day) Product
RX3STM	AIRS.2002.09.01.L3.RetStd030.v4.0.9.0.G05031160923.hdf	AIRS-Suite	50	1/30	2	L3 Standard Monthly Product

## Appendix C-2. AIRS Dynamic Inputs

### Appendix C-2. AIRS Dynamic Inputs

ESDT Short Name	Sample File Name (Local Granule ID)	PCF LID	Instr.	Usage	Daily Rate (MB per Day)	Description
PM1EPHND	PM1EPHND#001040920021200000000001	10501		L1A Dynamic Ancillary Input	6.0	Definitive Spacecraft Ephemeris
PM1ATTNR	PM1ATTNR#001040920021200000000001	10502		L1A Dynamic Ancillary Input	6.0	Restituted Spacecraft Attitude
PMCO_HK	DAAC_INST_CARRYOUT-pm_1-epds-2002118005744-2002118010019-01.dmf	4007 & 4008		L1A Dynamic Ancillary Input	12.0	Aqua housekeeping carryout file, including spacecraft & passive analog data
AIRH0ScE	P1540342AAAAAAAAAAAAAAAA01264200000000.PDS	342/9342	HSB	L1A Product Input	2.2	APID 342/9342: All Science Data Packets collected by the HSB instrument during one scan period
AIR10XNM	P1540257AAAAAAAAAAAAAAAA01264200000000.PDS	257/9257	AMSU -A	Special Case: L1A Product Input	[1.8]	Special Case: APID 257/9257 AMSU-A1 Science Data Packets - No Mode; substituted for APIDs 261 & 262 when instrument is in "No Mode"
AIRAACAL	P1540259AAAAAAAAAAAAAAAA01264200000000.PDS	259/9259	AMSU -A	Special Case: L1A Product Input	[7.7]	Special Case: APID 259/9259 AMSU-A1 Science Data Packets - Staring Mode Packet 1; substituted for APID 261 when instrument is in "Staring Mode"

## Appendix C-2. AIRS Dynamic Inputs

AIRASCAL	P1540260AAAAAAAAAAAAAAAA01264200000000.PDS	260/ 9260	AMSU -A	Special Case: L1A Product Input	[5.4]	Special Case: APID 260/9260 AMSU-A1 Science Data Packets – Staring Mode Packet 2; substituted for APID 262 when instrument is in "Staring Mode"
AIR10SCC	P1540261AAAAAAAAAAAAAAAA01264200000000.PDS	261/ 9261	AMSU -A	L1A Product Input	0.4	AMSU-A1 Science Full-Scan #1 Packets APID 261/9261: AMSU- A1 Science Data Packets collected during one full scan of the instruments operating in Full- Scan Mode
AIR10SCI	P1540262AAAAAAAAAAAAAAAA01264200000000.PDS	262/ 9262	AMSU -A	L1A Product Input	0.4	AMSU-A1 Science Full-Scan #2 Packets APID 262/9262: AMSU- A1 Science Data Packets collected during one full scan of the instruments operating in Full- Scan Mode
AIR20XNM	P1540288AAAAAAAAAAAAAAAA01264200000000.PDS	288/ 9288	AMSU -A	Special Case: L1A Product Input	[1.1]	Special Case: APID 288/9288 AMSU-A2 Science Data Packets – No Mode
AIR20XSM	P1540289AAAAAAAAAAAAAAAA01264200000000.PDS	289/ 9289	AMSU -A	Special Case: L1A Product Input	[0.2]	Special Case: APID 289/9289 AMSU-A2 Science Data Packets – Staring Mode
AIR20SCI	P1540290AAAAAAAAAAAAAAAA01264200000000.PDS	290/ 9290	AMSU -A	L1A Product Input	0.2	APID 290/9290 AMSU-A2 Science Data Packets collected during one full scan of the instruments operating in Full- Scan Mode

## Appendix C-2. AIRS Dynamic Inputs

AIRB0SCI	P1540404AAAAAAAAAAAAAAAA01264200000000.PDS	404/ 9404	AIRS	L1A Product Input	624.9	AIRS Scene Packets APID 404/9404: Each packet in this collection contains ground footprint data collected by the AIRS instrument for one footprint position. There are 90 of these packets for each scan of the AIRS instrument.
AIRB0CAL	P1540405AAAAAAAAAAAAAAAA01264200000000.PDS	405/ 9405	AIRS	L1A Product Input	6.9	AIRS Spacelook Packets APID 405/9405
AIRB0CAH	P1540406AAAAAAAAAAAAAAAA01264200000000.PDS	406/ 9406	AIRS	L1A Product Input	6.9	AIRS Blackbody Packets APID 406/9406
AIRB0CAP	P1540407AAAAAAAAAAAAAAAA01264200000000.PDS	407/ 9407	AIRS	L1A Product Input	6.9	AIRS Spectral/ Photometric Packets APID 407/9407
AIRH1ENC	P1540414AAAAAAAAAAAAAAAA01264200000000.PDS	414/ 9414	AIRS	L1A Product Input	6.9	AIRS STD HR ENG #1 Packets APID 414/9414
AIRH2ENC	P1540415AAAAAAAAAAAAAAAA01264200000000.PDS	415/ 9415	AIRS	L1A Product Input	6.9	AIRS STD HR ENG #2 Packets APID 415/9415
AIRH1ENG	P1540416AAAAAAAAAAAAAAAA01264200000000.PDS	416/ 9416	AIRS	Special Case: L1A Product Input	[6.9]	Special Case: AIRS Flex HR ENG #2 Packets APID 416/9416; substituted for APID 414 when instrument is commanded to produce flexible engineering data
AIRH2ENG	P1540417AAAAAAAAAAAAAAAA01264200000000.PDS	417/ 9417	AIRS	Special Case: L1A Product Input	[6.9]	Special Case: AIRS Flex HR ENG #2 Packets APID 417/9417; substituted for APID 415 when instrument is commanded to produce flexible engineering data

## Appendix C-2. AIRS Dynamic Inputs

AVI3_ANH	gblav.1998-09-12.T18Z.PGrbF03.anc	2203, 2213, 2223, 2233 & 2243	L2 Dynamic Ancillary Input	328.0	Aviation forecast from model; 2203, 2213, 2223, 2233 & 2243: 3-hour aviation forecast for 18Z-hour, 00Z-hour, 06Z- hour, 12Z-hour, 18Z-hour, respectively, cycle time on day prior to day in which granule starts
AVI6_ANH	gblav.1998-09-12.T18Z.PGrbF06.anc	2206, 2216, 2226, 2236 & 2246	L2 Dynamic Ancillary Input	328.0	Aviation forecast from model; 2206, 2216, 2226, 2236 & 2246: 6-hour aviation forecast for same model as 2203, 2213, 2223, 2233 & 2243, respectively
AVI9_ANH	gblav.1998-09-12.T18Z.PGrbF09.anc	2209, 2219, 2229, 2239 & 2249	L2 Dynamic Ancillary Input	328.0	Aviation forecast from model; 2209, 2219, 2229, 2239 & 2249: 9-hour aviation forecast for same model as 2203, 2213, 2223, 2233 & 2243, respectively
PREPQCH	L2.gdas1.980913.T00Z.BufPREPda.anc	6400	RaObs PGE Dynamic Ancillary Input	12.0	NOAA Radiosonde Observations

## Appendix C-3. AIRS Static Ancillary Inputs

### Appendix C-3. AIRS Static Ancillary Inputs

ESDT Short Name	Sample File Name (Local Granule ID)	PCF LID	Instr.	Usage	File Size (MB)	Description
AIRXADCM	L1A.decom_map_hsb.v1.1.0.anc	4001		L1A Ancillary Input	0.04	Decom Map
AIRIARAN	L1A.eng_sumry_fds.v1.0.0.anc	4011	AIRS	L1A Ancillary Input	0.03	Limits for selected AIRS engineering parameters
AIRXACRV	L1A.tlm_calcurve_amsu.v1.1.1.anc	4009		L1A Ancillary Input	0.05	Calibration conversion data numbers ranges
AIRXAPLY	L1A.tlm_polyconv_amsu.v1.1.0.anc	4010		L1A Ancillary Input	0.01	Polynomial conversion constants
AIRXARYL	L1A.tlm_rylim_airs.v2.0.0.anc	4005		L1A Ancillary Input	0.60	Red & Yellow Limits
AIRXAGEO	L1A.geolocation.v2.4.0.anc	4006		L1A Ancillary Input	0.01	Geolocation Parameters
AIRHBPAP	L1B.HSB_AncMain.v2.0.0.anc	3601	HSB	L1B Ancillary Input	0.01	HSB calibration parameters
AIRHBSLC	L1B.HSB_SLCorr.v1.0.0.anc	3602	HSB	L1B Ancillary Input	0.03	HSB sidelobe correction matrices

### Appendix C-3. AIRS Static Ancillary Inputs

AIRHBSLI	L1B.HSB_SLInterp.v2.0.0.anc	3604	HSB	L1B Ancillary Input	0.01	HSB cold sidelobe interpolation arrays
AIRABPAR	L1B.AMSU_AncMain.v2.0.0.anc	3501	AMSU-A	L1B Ancillary Input	0.01	AMSU-A calibration parameters
AIRABSLC	L1B.AMSU_SLCorr.v1.0.0.anc	3502	AMSU-A	L1B Ancillary Input	0.04	AMSU-A sidelobe correction matrices
AIRABSLI	L1B.AMSU_SLInterp.v2.0.0.anc	3504	AMSU-A	L1B Ancillary Input	0.04	AMSU-A cold sidelobe interpolation arrays
AIRXBPAR	L1B.config_file1.v1.2.0.anc	3005	AIRS	L1B Ancillary Input	0.06	L1B Calibration parameters
AIRIBFRQ	L1B.airs_freq.v1.0.0.anc	3006	AIRS	L1B Ancillary Input	0.02	AIRS frequency list
AIRIBFPM	L1B.airs_focal_plane_map.v1.1.0.anc	3007	AIRS	L1B Ancillary Input	0.001	AIRS focal plane map
AIRIBSFF	L1B.spectral_feature.v1.2.0.anc	3010	AIRS	L1B Ancillary Input	0.17	AIRS spectral features
AIRIBNLC	L1B.non_linear_corr.v1.1.0.anc	3011	AIRS	L1B Ancillary Input	0.09	AIRS Non-linearity correction coefficients
AIRIBPOL	L1B.polarization_corr.v1.1.0.anc	3012	AIRS	L1B Ancillary Input	0.04	AIRS polarization correction coefficients

### Appendix C-3. AIRS Static Ancillary Inputs

AIRIBSVS	L1B.space_view_sel.v1.0.0.anc	3013	AIRS	L1B Ancillary Input	0.0007	AIRS space view selection parameters
AIRIBPOP	L1B.popcorn_corr.v1.0.0.anc	3014	AIRS	L1B Ancillary Input	0.01	AIRS popcorn correction parameters
AIRIBQPR	L1B.airs_qa.v1.3.0.anc	3015	AIRS	L1B Ancillary Input	0.3	AIRS QA parameters
AIRVBCPR	L1B.vis_param.v1.0.0.anc	3009	AIRS	L1B Ancillary Input	0.003	VIS calibration parameters
AIRVBQPR	L1B.vis_qa.v1.1.0.anc	3016	AIRS	L1B Ancillary Input	0.01	VIS QA parameters
AIRI2TMC	L2b.trcoef.airs.v5.1.0.anc	2001	AIRS	L2 Ancillary Input	36.9	AIRS IR Channel Transmittances
AIRA2TMC	L2.trcoef.amsu.v3.0.0.anc	2002	AMSU-A	L2 Ancillary Input	0.13	AMSU-A Transmittances
AIRH2TMC	L2.trcoef.hsb.v3.0.0.anc	2003	HSB	L2 Ancillary Input	0.05	HSB Transmittances
AIRX2CLI	L2.uars_clim.v1.0.1.anc	2005		L2 Ancillary Input	1.2	Climatology to set initial guess profiles
AIRX2AAC	L2h.angle_adj_coef.v2.1.4.anc	2006		L2 Ancillary Input	40.9	Angle Correction Coefficients

### Appendix C-3. AIRS Static Ancillary Inputs

AIRX2AEI	L2.F.error_est.v1.0.0.anc	2007		L2 Ancillary Input	0.01	Ancillary error estimate inputs
AIRX2ABT	L2h.brtemp_tuning_coef.v2.0.0.anc	2008		L2 Ancillary Input	29.4	BRTemp Tuning Coefficients
AIRI2SRD	L2.airs_solar_rad.v5.1.0.anc	2009	AIRS	L2 Ancillary Input	0.06	Solar radiances
AIRX2CAV	L2.cloud_avg.v2.0.0.anc	2010		L2 Ancillary Input	0.24	Parameters determining channel averaging vs. extrapolation
AIRM2MEC	L2.M.ecof_705.v1.0.0.anc	2011		L2 Ancillary Input	0.004	MW emissivity coefficients
AIRM2MCM	L2.M.cov100av.v1.0.0.anc	2012		L2 Ancillary Input	0.22	MW temperature profile covariance matrix
AIRH2AAW	L2.M.weight.hsb.v1.0.0.anc	2013	HSB	L2 Ancillary Input	0.003	HSB ASCII Weight
AIRI2CHP	L2.I.channel_prop.v5.1.2.anc	2014	AIRS	L1B AIRS & L2 Ancillary Input	0.21	AIRS Channel properties
AIRI2OLR	L2h.F.coef_olr.v1.0.0.anc	2015		L2 Ancillary Input	0.06	Outgoing longwave radiation coefficients
AIRX2ICW	L2.I.peak_wgt.v2.0.0.anc	2021		L2 Ancillary Input	0.17	FIRST cloud clearing weighting function sensitivities

### Appendix C-3. AIRS Static Ancillary Inputs

AIRX2MAS	L2.masuda.v1.0.0.anc	2016		L2 Ancillary Input	0.06	Coefficients for Masuda model of ocean emissivities
AIRX2CTC	L2.l.cleartest_coef.v2.0.2.day.anc	2054 & 2055		L2 Ancillary Input	0.004	Coefficients to predict AIRS radiance from AMSU-A
AIRI2FRQ	L2.l.clr.regcoef.v1.0.1.anc	2056 & 2057		L2 Ancillary Input	1.1	Clear sky detection regression coefficients
AIRI2FEV	L2.l.eigvec_allang.solang.nf.v2.0.0.anc	2041 & 2042	AIRS	L2 Ancillary Input	6.6	FIRST retrieval first guess matrix of eigenvectors for nighttime footprints
AIRI2FRD	L2.l.rcoef.solang.v2.0.0.anc	2043 & 2044	AIRS	L2 Ancillary Input	0.6	FIRST first guess principal component mode regression coeff daytime footprints
AIRI2IFC	L2.l.freq.eigvec.v2.0.0.anc	2045	AIRS	L2 Ancillary Input	0.02	FIRST retrieval first guess eigenvectors AIRS channels list
AIRX2ANG	L2.l.ang_pc.v2.0.0.anc	2046		L2 Ancillary Input	7.9	Principle components for angle adjustment
AIRX2ICM	L2.l.airs_covmtx.v2.0.0.anc	2051		L2 Ancillary Input	0.6	FIRST physical retrieval covariance matrix for L2 parameters
AIRX2ITC	L2.l.freq.tmp.ret.v2.0.0.anc	2052	AIRS & AMSU-A	L2 Ancillary Input	0.001	FIRST retrieval temperature channel list for AIRS and AMSU-A
AIRX2IWC	L2.l.freq.h2o.ret.v2.0.0.anc	2053	AIRS & HSB	L2 Ancillary Input	0.001	FIRST retrieval water channel list for AIRS and HSB

### Appendix C-3. AIRS Static Ancillary Inputs

AIRX2NLD	L2_DEFAULTS100.v2.0.4.anc	2061		L2 Ancillary Input	0.01	Namelist giving default values for L2 parameters
AIRV2PRM	L2.vis_nir.v2.0.0.anc	2065	AIRS	L2 Ancillary Input	0.001	V/NIR parameters
AIRHBMLC	BR.L1B.HSB_limb.v1.0.0.anc	3703	HSB	HSB Daily Browse PGE Ancillary Input	0.01	HSB L1B browse limb correction
AIRHBCTB	BR.L1B.HSB_hdf_color_tbl.v1.0.0.anc	3705	HSB	HSB Daily Browse PGE Ancillary Input	0.001	HSB L1B browse color table
AIRABMLN	BR.L1B.AMSU_limb_nosea.v1.0.0.anc	3701	AMSU-A	AMSU Daily Browse PGE Ancillary Input	0.03	AMSU L1B browse limb correction – no sea
AIRABMLS	BR.L1B.AMSU_limb_sea.v1.0.0.anc	3702	AMSU-A	AMSU Daily Browse PGE Ancillary Input	0.029	AMSU L1B browse limb correction – sea
AIRABCTB	BR.L1B.AMSU_hdf_color_tbl.v1.0.0.anc	3704	AMSU-A	AMSU Daily Browse PGE Ancillary Input	0.001	AMSU L1B browse color table
AIRIBCTB	BR.L1B.AIRS_hdf_color_tbl.v1.0.0.anc	3705	AIRS	AIRS Daily Browse PGE Ancillary Input	0.001	AIRS L1B browse color table
AIRX2BCTB	BR.L2.RET_hdf_color_tbl.v1.0.0.anc	2082	AIRS	AIRS L2 Retrieved Product Daily Browse PGE Ancillary Input	0.001	AIRS L2 Retrieved Product browse color table
AIRI2BCTB	BR.L2.CC_hdf_color_tbl.v1.0.0.anc	2081	AIRS	AIRS L2 Retrieved Product Daily Browse PGE Ancillary Input	0.001	AIRS L2 Cloud-Cleared Radiance browse color table

### Appendix C-3. AIRS Static Ancillary Inputs

AIRVBVIM	AVHRR_NDVI_Apr11to20_1993.v1.1.0.anc	2301 - 2312	AIRS	L2 Ancillary Input	700	Static monthly mean multiday surface visible maps, for use when no dynamic AIRVBVIM available
AIRX3LND	L3h.land_sea_mask_1x1.v1.0.0.anc	2090	AIRS-Suite	L3 ancillary input	1	Land/sea mask 1 degree square lat/lon

### Appendix C-3. AIRS Static Ancillary Inputs

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